August

RADIO, TELEVISION and HOBBIES

Volume 23, Number 5 **August, 1961**

STILL TIME TO SAVE FM

WITH the FM stations now officially silenced, some leaders in the electronics industry are waking up to the fact that a vital step has been taken while they were busy thinking about something else. In accepting the formula for 13-channel VHF television, they have condoned the decimation of a valuable potential market for high-fidelity stereo receivers.

What has underlined the fact, more than ever, is that termination of FM broadcasting in Australia just about coincides with the inauguration, in the U.S.A., of stereo broadcasting using FM multiplex.

In earlier issues, I suggested that the present FM transmitters could easily be accommodated in the space still available between 92 and 94 Mc, along with such additional transmitters as might be necessary to carry a third A.B.C. program. Experts who have studied the proposition now claim that space is available in this region to accommodate 10 distinct FM channels. By judicious allocation, taking advantage of geographical isolation, multiplexing, etc., they state that it would be entirely possible to provide a valuable supplementary service to the present medium-wave AM stations.

They do not accept the statement by the Postmaster-General that such a service is not practical. They stress the importance of keeping in step with overseas FM practice and the extreme difficulties of developing FM in the UHF region, in the present state of the art.

The article on the Citizens Band on page 3 has more than a slight bearing on the overall picture. One of the reasons why the P.M.G. Department is finding such difficulty in accommodating mobile radio services is that numerous applications have been lodged by small concerns, which the P.M.G. cannot easily refuse. Yet, in practice, the channels allotted receive quite small or quite trivial use.

The provision of a Citizens Band, similar to American Class D operation, would suffice for numerous one, two and three-station mobile systems, currently enjoying higher priority. It could mean the difference between retaining or losing those vital 2 Mc. for FM broadcasting.

To be sure, the FM transmitters are temporarily silent, to the dismay both of hi-fi enthusiasts and listeners in certain difficult areas. But it isn't too late—even now—for the Postmaster-General to rethink the problem and take note of what his own departmental officers have, through the years, set out in official reports.

W. N. Williams

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Cover Picture:

An era covering some thirty years is drawing to a close in New Guinea and, with it, reminders of the first big airlift in aviation history. Piece by piece, three Junkers tri-motor monoplanes flew eight huge dredges to the Bulolo goldfields, often landing on a strip 3500 feet above sea level and with an 8 p.c. gradient for good measure. During 1931-32 Guinea Airways handled more freight in one month than all the world's airlines put together, in one year. Now only one dredge remains in operation. (Picture taken by Warren Clark, Qantas.)

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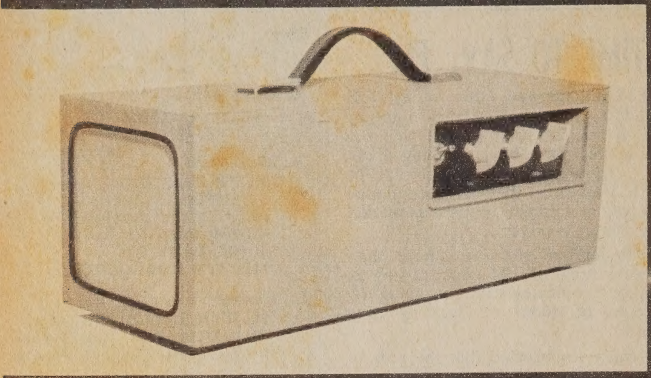

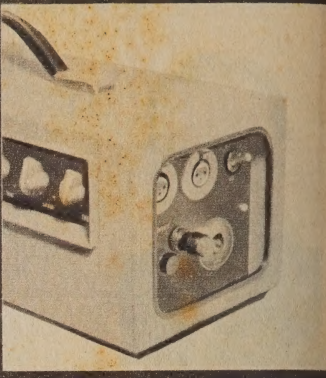

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World renowned for dependability and high quality in the aviation industry, de Havilland now introduces new values to the electronic equipment market.

The first in a range of fully transistorised equipment is the de Havilland 10 Watt portable public address system. It is remarkable value at a trade price of £41.1.5 (plus tax).

This versatile, lightweight (17¼ lbs. incl. batteries) public address system has all the worthwhile features of larger equipment plus the advantages of: easy portability — built-in self-contained power supply — low power consumption — high output (10 Watts) — built in monitor speaker — compact size for easy carrying and storage (14″ x 5″ x 5″).

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The unit may also be used in conjunction with a microphone with a flexible lead as a low-powered fixed speaker unit.

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URGENT—FOR MISSILE TRACKING

To produce 11,000 units urgently for tracking stations throughout the world, Lockheed's Missile and Space Division, at Van Nuys, California, either had to make a temporary and uneconomic increase in staff, or step up the production rate by streamlining existing techniques. Selecting the latter course, they successfully trimmed the completion time for typical printed circuit boards from four hours to one hour fifteen minutes. Techniques included multiple drilling of up to 86 holes at the one time in 24 boards. Boards were then washed in detergent, 200 at a time in a modified home-type dishwasher. A single tool operation was devised to trim and flatten wires passed through the board, followed by dip soldering. Operators were trained to peak efficiency with audio visual aids and worked to selected background music. Checking results is Lockheed engineer Ralph Schamp.

It's Time We Took A Look At The

CITIZENS' RADIO SERVICE

—By The Editor

This article concerns every reader of "Radio, Television and Hobbies," plus a lot of other people as well. It concerns a facility which thousands of people want but which they haven't yet enjoyed. It concerns something which could open up a vital new field of activity for our flagging electronics industry. It may involve an overhaul of present regulations but is that good enough reason for us not to have a Citizens Radio Service? Now read on:—

- A harvesting crew, perhaps members of one family, are a good mile from the homestead. There's an urgent reason why one of them should drive into town but there's no way of attracting his attention. Either someone has to walk the distance or the matter has to wait till the crew comes in for lunch.
- A scout troop is on weekend camp in a national park. Various group activities are in progress around the site but there's no easy way of maintaining communication between groups for organisational purposes.
- A holiday party is fishing on the lake, oblivious of the fact that friends have called to see them. The annoying part is that their boat can be seen in the distance but it's impossible to attract their attention. By the time they come in, the visitors will have had to leave.
- A plumber is working around his own suburb, supervising a couple of contract jobs, quoting for a couple of others, doing some buying, checking with the local council. He's never very far away from home but his wife can't get in touch to tell him about another job that urgently needs his attention.
- A motorist, approaching a provincial town wants minor service on his car and accommodation for the night in a motel. In the town is a service station and a motel anxious for his business but they don't know about him and he doesn't know about them!

These are just five of a thousand typical cases where somebody wants urgently to get in touch with somebody else, who can't be reached by telephone.

The matters may be purely personal or purely business but, to the parties involved, they are important.

But how important?

Important enough to spend money on? Very possibly.

Important enough to justify the allocation of an official and exclusive mobile radio channel? Probably not.

ANNOYANCE, FRUSTRATION

So mother leaves her work and toils across the ploughed field.

The scouts do without their inter-group communication.

The holiday party fishes on and their visitors drive helplessly away.

The plumber learns about the urgent job — too late.

The motorist wastes a half-hour or more making futile door-to-door calls.

Not necessarily.

If the people involved in these and similar typical situations happen to live in the United States, they can take steps to prevent a repetition of the situation. They can get in touch with their local radio dealer and have him offer and demonstrate a variety of two-way radio-telephone equipments designed especially for C.R.S. — Citizens' Radio Service—and intended to bridge these annoying, everyday gaps.

These are not big, powerful transmitters and receivers of the type used by the various public utilities. In fact, their power and their aerial arrangements are limited by regulation — and the difference is reflected in the purchase price.

Their owners don't enjoy an exclusive frequency allocation or even one that is shared only by services in geographically remote locations. They can't expect secrecy of communication. Like people on a party line, they depend a good deal on the goodwill of others possessing similar equipment but here's the point:

They can radiate a call with a good chance that it will be heard by the person whom they wish to contact, even if they have to wait a while or try a couple of times.

And what is no less important:

They don't have to run the gauntlet of official questions; they don't have to know any more about the equipment than is necessary to operate it properly; they don't have to establish the kind of need which will bring tears to official eyes. The fact that they are prepared to purchase the equipment is accepted as prima facie evidence that they have some need of it.

In short, the Federal Communication Commission recognises the fact that individual citizens or citizen groups hav a need to pass "substantive" though no vital messages. In pursuance of this they have set up a system which seek to make the facility available as simpl as possible to adult citizens who are prepared to use approved equipment, in a approved fashion for legitimate purpose

THE ROLE OF C.R.S.

The Citizens' Radio Service supplements but does NOT supersede norma fixed and mobile radio systems used b essential services such as police, ambulance, fire brigades, major public util ties, newspapers and so on. These se vices need exclusive high priority char nels, and equipment which will giv them the greatest possible area cove age within the terms of their licence.

Equally important, C.R.S. commur cation is NOT a competitor for rad amateurs. In fact, the regulations ar specifically designed to deter "ra chewing," nets, "DX" working, gener "CQ's" and the technical experimentir which goes on in the Amateur bands

Amateurs justify their existence larg ly by the skills and the knowledge whic they acquire while pursuing their hobb They have to pass a technical examin tion, because a foundation of technic knowledge is necessary to their acti ties. And, because they have such tec nical knowledge, they are permitted operate in a variety of frequency ban ind to experiment to their heart's con- ent with relevant equipment.

The Citizens' Radio Service does not xist for experimental purposes. In fact, o permit "fiddling" by non-technical perators would invite chaos.

The service exists purely as a facility or those who wish to communicate with ther specified persons for reasons which —to them—are important enough to ustify spending a few hundred dollars.

In this respect it's a commodity as nuch as a facility. If a person wants to vatch television, they invest in a tele- ision receiver. If their desire to play tereo records is strong enough, they uy a stereogram. If they want to pass nessages to another person who can't e reached more easily or cheaply in nother way, they buy a couple of CB inits and use them subject to FCC censing.

Well then, has this special facility een patronised in the United States?

Information recently to hand suggests hat, in the last two years, 125,000 cences have had granted for Citizens' and operation.

As at September, 1960, applications or new licences were reaching the Fed- ral Communications Commission at the ate of 12,000 per month.

UBSTANTIAL PRODUCTION

Equipment to meet this demand was urrently being produced by some 50 anufacturers.

Since the equipments are by no means heap, the foregoing figures obviously ndicate an important and growing acti- ty for the electronics industry.

What is the position in Australia?

First and foremost, terms like "Citi- ns' Band" and "Citizens' Radio Ser- ce" do not exist in official parlance, en though activities and facilities are ailable, parallel to some of those hich are included under these general adings in the U.S.

In fact, numerous allocations are ope- ted throughout the spectrum, some of hich are widely known, others not so.

In the VHF regions adjacent to 70 d 160 Mc. a very large number of hicular mobile services are currently operation serving public utilities and mmercial organisations. Recently, essure on space in these regions has come so great that expansion into the HF region adjacent to 500 Mc. is evitable.

A variety of allocations have been ade in the HF (or shortwave) region rving small ships, aircraft, flying doc- r, bushfire services and so on, even to w power walkie-talkie equipment ope- ted by people who have sufficient ason to use it.

In addition, permits can be obtained operate models by remote control, en garage doors, etc., while very low wer transmitters can be used on speci- d frequencies to carry voice, music or her signal one-way, into radio receiv- and/or public address amplifiers.

In such respects, facilities available the Australian public would appear differ only in detail from those ope- ing overseas, and include some of the ilities offered within the general con- pt of the U.S. Citizens' Radio Service.

The vital difference is the apparent ck of any real equivalent to the merican Class D Citizen Service, hich is the real "Citizens' Band."

THE U.S. CITIZENS' BAND—IN BRIEF

The operation of Citizens' Band type equipment is subject to close control by the Federal Communications Commission and involves much more detail than can be set out here. However, the following paragraphs summarise the types of operation which are commonly—though rather loosely—grouped under the title "Citizens' Radio Service" or "Citizens' Band." Possible questions which might arise from these paragraphs are anwered overleaf.

TERMINOLOGY:

The terms "Citizens' Band" and Citizens' Radio Service" tend to be misleading, at least to Australian readers because: (1) Various types of service are covered by the terms. Privately owned two-way radio-telephone is just one of them. (2) The frequencies involved by these services are not confined to a single band, as might be inferred. (3) Not all "Citizens' Band" (CB) equipment is used exclusively for citizen service. In some cases, the technical specifications are high enough to win type approval from the FCC for other applications.

CLASSIFICATIONS:

So-called "Citizens' Band Radio" is divided into four classifications, designated as A, B, C, and D. These classifications are explained separately below but the one which is of immediate interest to private citizens is class D.

CLASS A SERVICE:

This is concerned mainly with two-way radio-telephone communication with mobile units, operated by public utilities, industrial concerns and other groups who cannot be accommodated in exclusive VHF channels. Equipments operate on 68 specified channels, at present 50 Kc. apart in the frequency region 460 to 470 Mc. Maximum power permitted is 60 watts. Equipments may use either amplitude or frequency modulation and selective calling systems are permitted. Antenna heights are limited only by local building codes, air navigation regulations, etc., though operators are expected not to mount antennas in locations where they will cause unnecessary interference.

Typical equipments range in price from 575 dollars for a 10-12 watt mobile unit to over 800 dollars for the higher powered varieties. Most are frequency modulated.

CLASS B SERVICE:

This is a special sector in the region of 465 Mc. reserved for use by simpler equipment having a maximum transmitter power of 5 watts and using, if desired, a super-regenerative type receiver. In practice, some equipment designed primarily for class B service has been type-approved for class A service and may be used on frequencies assigned to Class A. Antennas for class B service may not extend more than 20 feet above the surface (roof or ground) on which the antenna-supporting structure is mounted.

Portable transceivers are available in the price range 75 to 105 dollars, with more powerful fixed base station equipments at about double these figures.

CLASS C SERVICE:

This is not for two-way radio-telephone working, though the equipment can be used to attract attention of another party. Involving specified spot frequencies in the vicinity of 27 Mc., the class C service is primarily concerned with mobile or portable low-power (5 watt) remote control functions, such as control of models, garage doors, etc. Either interrupted carrier or amplitude tone modulation may be used. Transmitters must be crystal controlled and, with fixed stations, operated only by special arrangement, the antenna height is limited as for class B service.

CLASS D SERVICE:

This is the service which is now of prime interest to private citizens and whose function is most closely related to the title "Citizens' Band." For two-way radio-telephone use, equipment operates on 23 channels 10 Kc. apart, between the frequency limits 26.965 and 27.255 Mc. Maximum transmitter power is 5 watts and amplitude modulation is standard. Transmitters must be crystal-controlled (0.002 p.c. or better) but channel selection at will is permitted, by replacing or switching crystals. Equipment marketed for class D service includes fixed, vehicular mobile and hand-portable, is powered by mains, storage batteries or dry cells, and uses valves or transistors as best suited to the design. In all cases, FCC type approval is required for the equipment. A typical all-transistor Handie-Talkie sells for about 100 dollars.

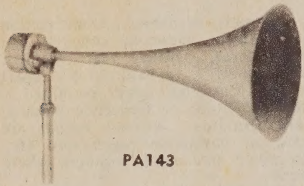
A licence is necessary to operate class D equipment but no case has to be made as to why it is required. The granting of a licence is subject only to the applicant being old enough, and prepared to operate the equipment for legitimate purposes and according to regulations.

Sound Distribution SPEAKERS

AWA manufacture the most complete range of speaker assemblies—there's a unit for every sound reinforcement need. AWA designs these speakers for maximum faithfulness in sound reproduction. Styles and finishes are available from stock or designed for individual use and circumstance.

PA138

Standard reflex horn speaker for medium distance projection of speech and incidental music.



PA143

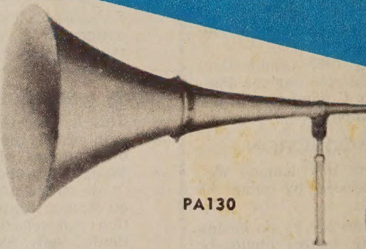
Short exponential horn speaker for distance projection of speech only.

Ivory timber cabinet with 7in speaker for applications where a bidirectional characteristic is desired.

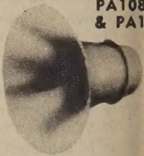
PA73

RESLO DRIVE UNITS
SU10 & SU12

Exclusive features are the self-locating diaphragm and the concentrically interlocked magnet which together produce an undisplaceable mechanical assembly proof against decentering.



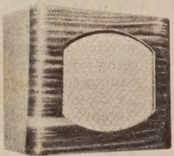
PA130



PA108
& PA1

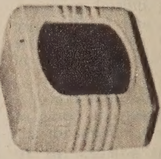
Standard exponential horn speaker for public address where distance projection of speech and incidental music is required.

These flare baffles are for use with 7in and 12in permanent magnet co speaker units and provide high conversion efficiency.



PA77/12PS

Polished timber cabinet for wall or table mounting with 12in cone speaker and 600 ohm line transformer.



PA150/1

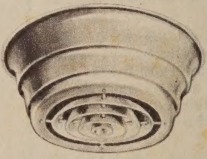
Attractive moulded cabinet with 7in cone speaker and 600 ohm line transformer. Suitable for wall or desk mounting. In grey, ivory and walnut.

PA343

General purpose
source reproducer
music and speech ra
100 to 7,000 cyc
Power capability 15 w
of programme.

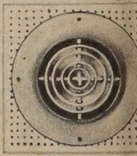
PA218

Designed for overhead mounting in contemporary styling. The unit can be suspended by chain or rod. Gives uniform response over a wide area.



PA188

For overhead mounting this is a surface style unit. 360-degree diffusion over a wide area. In smart styling to suit modern architectural treatments.



PA186

For flush mounting
unit has a reces
acoustic surround wh
mounts the complete
sembly above the ceil
line. 360-degree di
sion.

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To be sure, the facility exists for the Postmaster-General's Department to issue licences for private two-way radio telephone between the frequencies 27.23 and 27.28 Mc. According to reports, they have already licensed for use individual pieces of overseas CB equipment which have been imported by people wanting to use it.

But—applications for the use of such equipment are treated—and I quote—"on their merits" and licences granted accordingly. What this does (or could) mean in practice is open to speculation but the implication is that individuals have to convince the department of a need before a licence is granted. There is little to suggest that Departmental thinking is in any way parallel to the attitude which has been adopted by the American FCC.

It raises a variety of questions, including the following: (1) How great must be the need, and of what character? (2) Who arbitrates as to degrees of need? (3) If demand for licences should increase, possibly as a result of this very article, will the concept of "need" be tightened to limit the number of licences, or will the department's reaction be to make more frequencies available?

In fact, at this point, I would like to ask a whole series of questions, with the hope that some answers will be forthcoming.

What is the Department's attitude to the American plan of making licences freely available, equivalent to the American Class D Citizen Service?

If the attitude is favourable, are proposals actually in hand and are suitable frequencies being set aside?

Is the industry to be alerted so that planning can proceed and, if so, when?

If the attitude is against freely available licences, is it because the Department doubts its ability to administer and control a "Citizens' Band" or is there some other reason?

Is the Australian electronics industry so fully engaged that it does not need another outlet for its engineering products?

One could probably add a good few more questions to the above but they should suffice for a start. I believe that they are important to the individual, because they affect his right to use a facility which modern electronics has made available to him. They affect the electronics industry because, unless every possible outlet for its products is exploited, it will stagnate and shrivel.

I am well aware, of course, that arguments can be advanced against the conept of a Citizens' Radio Service, though not all of them stand close examination. t would call for a good deal of adminisration—though this could be paid for by licence fees. Frequency space would e required — though an enormous mount of traffic can be concentrated into a narrow band. Abuses of privilege may occur but this kind of service is self-levelling" to a considerable degree.

By all means let's hear the "cons." as well as the "pros." but at least let's have good look at the whole proposition. And if an Australian equivalent of the Citizens' Band is practicable, let's have without further delays!

SOME QUESTIONS AND ANSWERS

The following questions are typical of those which arise naturally from a discussion of the U.S. Citizens' Radio Service. The answers are accurate, to the best of our knowledge, being based on current American literature. Confirmation of detail would demand complete analysis of FCC regulations.

Don't people using Class-D Citizens' Band equipment really become unlicensed amateurs?

Definitely not. Regulations limit its use to passing brief, "substantive" messages. They specifically prohibit most of the activities in which amateurs commonly engage.

Cannot operators of Class-D equipment call "CQ" or chat to strangers?

In general, no. The basic assumption is that the equipment will be used to pass substantive messages between individuals who are in some way associated, or who have a definite message to pass. There are exceptions, however, such as for travellers who wish to contact motels or service stations in their immediate area, seeking bookings or assistance.

Do operators have to be licensed?

Not as individuals but each system has be licensed and operated under the supervision of the licensee. He or she is responsible for all equipments covered by the licence.

What is the age limit for Class D licences?

Licensees must normally be over 18 years of age.

Is there any delay in issuing licences?

Serious delays have occurred in the past, largely due to shortage of forms, handling problems, etc. "Processing" time is currently about 60 days.

Are licensees limited to operation on one channel?

No. A licensee may operate at will on any of the 23 channels but it is usually in the common interest to observe voluntary arrangements which keep certain channels clear for certain classes of traffic, viz., motel bookings, small ships, etc.

Is the nature of messages limited which can be passed?

Messages can be passed relating to either legitimate business or recreational activities, with the proviso that use of the equipment does not in itself, constitute the recreation.

Can business concerns operate equipment in the Class D Service?

They can and some do, partly because of fewer restrictions, partly because the equipment available is often cheaper.

Is the number of equipments operated by one licensee in any way limited?

Licences are endorsed for a certain number of equipments and this must not be exceeded without arrangement with the FCC. Licence to operate a single equipment may be granted where it is required to communicate with another specified licensee.

Does all equipment for use in the Class D service need to be licensed?

No. Equipments with a power rating of 0.1 watt or less, using an aerial of 60 inches or less and operating within specified frequency limits may be used without license, provided they are certified by a manufacturer as conforming to FCC requirements. They must be included in a licence, however, when associated with other licensed Class D equipment.

Is it permissible for technically qualified people to build their own class D equipment to save cost?

Home-made equipment cannot be used with the same freedom as, for example by amateurs using the amateur bands. CB equipment is normally commercially manufactured and type approved by the FCC Home construction is permitted only when using complete type-approved kits.

What distances are normally covered by Citizens' Band equipment?

Distances are very hard to predict, being affected by equipment power and sensitivity, aerial siting and propagation conditions. As a purely general statement, the practical range of equipment other than handie-talkies is seldom less than 1 mile, with 3 to 5 miles as a likely average. This can extend to 5 to 10 miles in open water or country. In the 27Mc. band, special propagation conditions may cause the signals to be heard over distances of some thousands of miles but such conditions are, at the one time, both a novelty and a nuisance, because they increase interference problems.

Has American Citizens' Band operation led to abuses or confusion?

Difficulties have occurred both because of unsuitable frequency allocations in the first instance and because, later, firms and individuals started to treat the CB allocations as a "free" amateur band. Current allocations and regulations are designed to combat these tendencies.

Don't use an abrasive tape !

Your recorder head will last 5 times longer with MIRROR FINISH BASF TAPE

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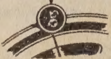
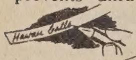
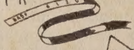
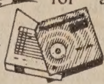
Look for these features on every famous BASF tape: factory seal  your guarantee of a brand new tape, red safety clip prevents unravelling, green and red leader  for writing your titles on. metal foil strip  for automatic stop recorders, swivel box  never loses lid.

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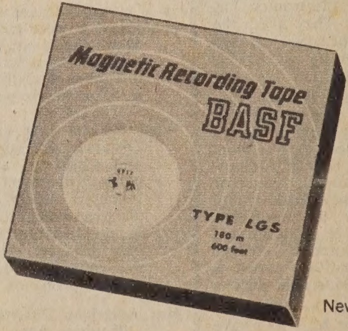

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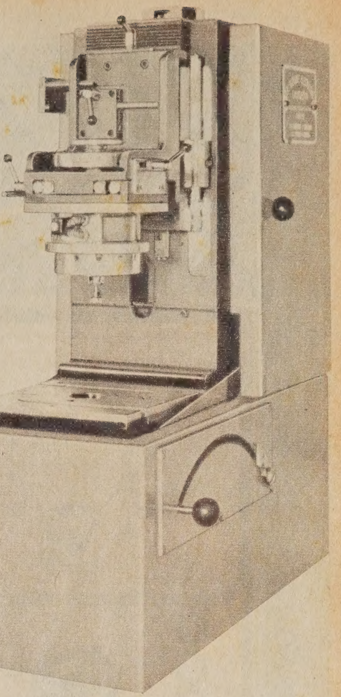
T83

ELECTRON MACHINING

Sparks Replace Cutting Tools

High voltage electrical discharges are being harnessed by modern techniques to perform machining operations which would be difficult, if not impossible, using physical cutting tools. Unwanted metal is removed by what are known as "micro explosive dissolution."



A bench model precision spark erosion machine, marketed under the name "Seleromic."

THAT spark discharges could erode metal was first observed by Priestly n 1762, but it is only within the past ew years that the principle has come to e applied to the actual machining of netals.

Spark erosion — or electron machining – is particularly suitable for machining naterials which, because of their hardness or toughness, may be excessively lifficult to machine by conventional nethods.

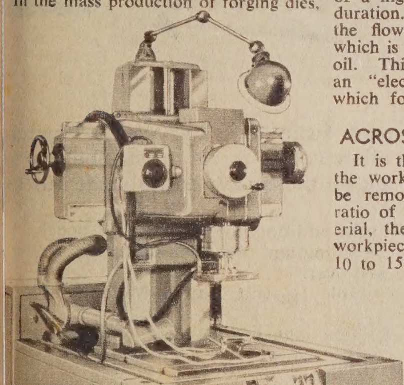
It can also be used on intractable naterials such as stellite, tungsten-carbide and magnet steel, to produce openngs and cavities which might be quite npossible to form by ordinary machining methods.

NO CONTACT

There is no mechanical contact between electrode and workpiece, and this nables holes of any size or shape to be ierced in thin and/or delicate materials vhich would be deformed by the pressure of normal cutting tools.

The forming of irregular openings in orging, blanking and extrusion dies is n important abilty of spark erosion. The ommon practice of assembling numerous recision-ground pieces in order to form n irregular cavity in a die can be eliminated in favour of a one piece homogeneous unit.

In the mass production of forging dies, as required in the motor industry for example, spark erosion has proved to be the most economical manufacturing method, not the least because it yields consistent accuracy in new sets of dies. The inaccuracies of traditional die making have been eliminated and the tolerances permissible on finished forgings are available to take in normal wear of the dies during production.



The "Seleromat B" machine, with erosion head carried on high precision co-ordinate slides and provided with vernier positioning equipment.

The essence of spark erosion is the production of spark discharge between two pieces of metal (the anode and cathode) separated by a small gap. The workpiece to be machined forms the anode, and the equivalent of the cutting tool in classical machining is the cathode—commonly referred to simply as "the electrode."

Because the spark discharge is of a transient nature it involves the passage of a high current for a relatively short duration. The current is produced by the flow of electrons across the gap, which is immersed in a suitable dielectric oil. This becomes ionized, until finally an "electron avalanche" is produced, which forms the spark discharge.

ACROSS GAP

It is the impact of these electrons on the workpiece which causes material to be removed and, because of the mass ratio of the electron to the eroded material, the greater erosion occurs at the workpiece. Electrode erosion is about 10 to 15 per cent of the workpiece erosion, depending on electrode characteristics and the erosion rate.

A spark is generated between electrode and workpiece when the potential difference across the gap is raised sufficiently to break down the resistance of the dielectric medium so that an electrically conducive path is created. The cross-sectional area of the spark is very small and current density reaches very high values, producing spark temperatures of up to 13,000 deg. C.

The energy is concentrated on the terminal areas of the spark path, and in a short duration spark there is insufficient time for localised heating to penetrate into the metal.

The heating is, however, such as to melt and evaporate the metallic particles at the spark terminal areas, and this, together with the powerful shock waves so generated, produces a localised micro-explosion which blasts material from the work surface and leaves a characteristic crater.

Crater size, and thus surface finish, is dependent upon the energy passed between electrode and workpiece. The lower the potential difference across the gap, the smaller will be the crater produced. Thus, by altering the discharge value across the gap, the surface roughness can be adjusted to suit the degree of finish required.

The spark always occurs at that point between electrode and workpiece where the gap is shortest, but, having occured and so caused metal removal which increases the gap distance at a given point, the discharge immediately moves to the next two points separated by the smallest gap. The spark thus wanders randomly over the area of erosion continuously reducing the successive high spots.

AUTOMATIC ADJUSTMENT

As the spark discharge progressively erodes both workpiece and electrode, the gap width is adjusted automatically by means of a servo-mechanism which feeds the electrode to the work in accordance with the conditions within the spark gap.

After the condenser has discharged across the gap and the dielectric surrounding the spark path has become deionised, the condenser re-charges and its voltage again rises to that of the breakdown voltage within the next gap, upon which it once more discharges, and so on.

NOW

new transistor tester model 100T by

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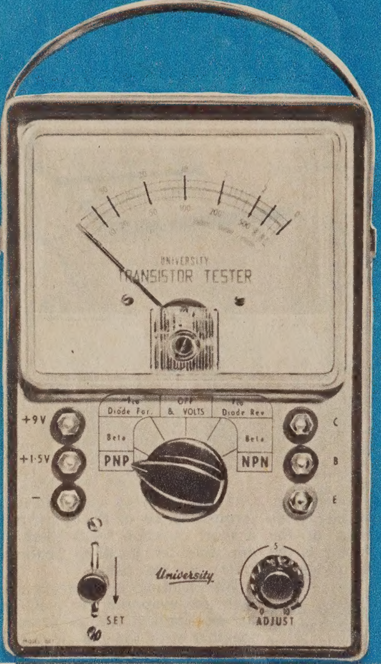

Here is a new-style instrument added to the ever-growing range of University test instruments for radio and TV service men and all radio and TV workshops.

This new transistor tester checks for both leakage and gain and, as an added feature, the easy-to-read scale and the special switc position allow you to test transistor batteries also. Look at these new desirable features

- New two-tone case and panel in matching greys make a pleasing addition to your service bench.
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- Only one size of battery is used in this transistor tester—the simple 1½-volt battery Model 950, available everywhere.
- The batteries are replaceable without opening the case, which gives added protection to your transistor tester.
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- Transistor batteries in the ranges of 1½ volts, 6 volts and 9 volts are quickly checked with the leads provided.
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16 FP.5

The frequency of sparking is a func- on of the condenser capacity in micro- arads and the frequency of the full ave rectified output of the single phase lternator.

Mechanical flushing away of debris achieved by the explosive effect of e spark discharge, by vibration of the ectrode and by high-pressure feeding the dielectric oil through the elec- ode.

A complete spark erosion machine in- allation comprises (i) the machine it- lf, (ii) the spark generator, which is oused in a separate cabinet and is nnected to the erosion head by a reened co-axial cable, and (iii) a fil- ation unit for removing micro-solids om the dielectric fluid.

Illustrated on this page are machines veloped by the French company, La udure Electrique Languepin. These achines are available to industry in e United Kingdom and the Common- ealth through a new Anglo-French com- ny, Solar Weld Languepin Limited, lledge Works, Burnley, Lancashire.

IELECTRIC OIL

The floor models are provided with welded steel base which houses a 100- llon tank for the dielectric oil, the mp mechanism and which also supports the work table and ancillary equip- ent.

The dielectric tank completely sur- unds the machine table and is raised d lowered electrically. The tank rises that the dielectric submerses the work- le, electrode and workpiece, and the cessity to fill and empty the tank for ch erosion operation is eliminated.

Level of dielectric in the tank is main- ned automatically and auto-control ar ensures that the erosion head is perable unless the electrode is sub- erged.

Finished to machine tool standards accuracy, the work-table measures 20 x 25in and has two T-slots for clamp- -bolts. The table will support work- ces weighing up to 1 ton.

Servo-electric circuitry operates to intain the required gap as work pro- sses and a simple control handle al- vs the machine to be readily set for ughing," "semi-roughing," "finishing" d "superfinishing."

When roughing, the erosion rate is ically 1000 cu.mm/min. with a sur- e finish of 50 microns and a toler- ce of .004 inch. "Superfinish" gives erosion rate of 2 cu.mm/min., a sur- e finish of 2 microns and a tolerance .0003 inch.

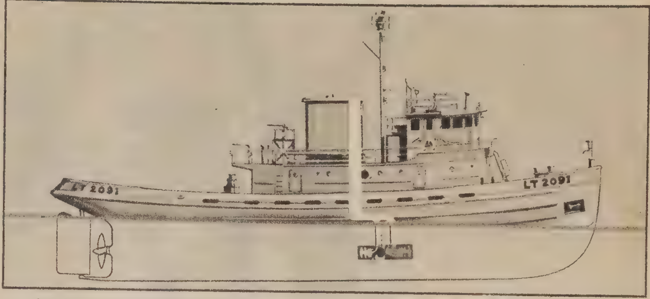
In the simpler models the servohead carried on a ground pillar, with verti- and horizontal movements controlled quick action clamps and screw mech- sms.

ECISION HEAD

In the more sophisticated model the sion head is mounted on precision ordinate slides, providing "jig-boring" itioning of the electrode over the rkpiece. Precision traversing mechan- is provided, with vernier adjust- nts and reading, allowing for a very h order of accuracy in setting.

The high rate of erosion requires a ious supply of clean dielectric fluid this is provided by a mechanical ration unit which can deliver fluid the rate of 11 gallons per hour, filt- d of all particles down to 1 micron size.

NOVEL USE FOR GAS TURBINES



Artist's sketch shows the position in which the gas turbines are being mounted and (white area) the exhaust ducts.

An unusual fire-fighting tug boat of the United States Army Transportation Corps will get its water-throwing ability from a pair of Boeing gas-turbine engines. This is just one more example of the many uses to which these modern light-weight high-powered engines are being put.

THE 100-foot ocean-going tug is having fire-fighting capability added at a commercial Atlantic Seaboard shipyard.

Equipment being installed includes two pumping units built by the Boeing Industrial Products Division in Seattle. Each unit consists of a 502-10MA gas turbine engine, pump, sub-base, enclosure, self-contained lubrication and automatic pump pressure controls.

Shaft horsepower rating of eacb turbine is 270. Pumps are of the close-coupled, single-stage, centrifugal type, with eight inch suction and eight inch discharge.

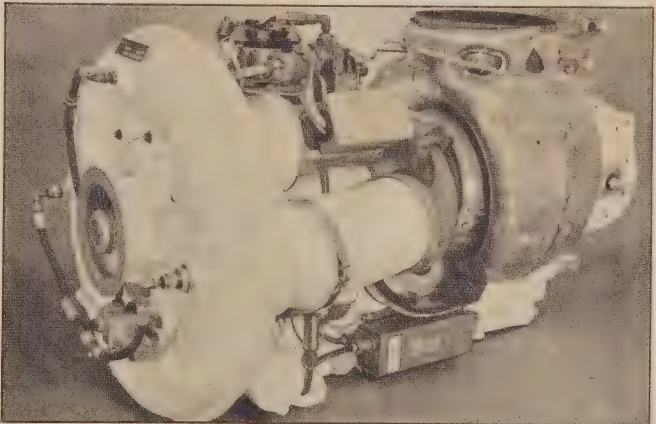
Each pump will move 2,000 gallons a minute at a pressure of 150 psi. The automatic pressure controls will enable the unit to pump at any preselected pressure up to 250 psi without manual adjustment, regardless of the number of fire-fighting hoses or monitors on the line.

After conversion, the vessel will be able to tow at full power while pumping at full capacity. The tug-fireboat will be based at Wilmington, North Carolina, and will be used for handling ships docking at Army terminals and fire protection.

The gas turbine was selected for this job because of the engine's compact size, starting reliability, ease of installation and competitive cost. The fact that turbine power plants do not deteriorate from infrequent use is another important factor in a fireboat application.

One pumping unit is being installed on each side of the engine room. Each pump draws from individual sea chests which are extra large and interconnected. The turbine exhaust is being ducted into the tug's main stack.

The new turbine pumping installation is expected to be completed shortly. The turbines are built to standards of the American Bureau of Shipping.



A close-up view of the light-weight Boeing 502 type gas turbine. With models delivering from 240 to 360 shaft horsepower, engine weight is as low as 265 pounds.

Most of us know that the moon has no atmosphere; that when man finally lands there he will have to wear a protective suit and carry his own air supply. But why has the moon no atmosphere? This will floor most people, but there is a very good reason, as we explain here.

Simple Facts We Seldom Think About

Readers interested in popular science inevitably encounter many small items which are not fully understood. This article is intended to cover a number of these points, ranging from density and specific gravity, to measurements in space and marine navigation.

By Calvin Walters

THIS month we will not confine ourselves to one particular subject. Rather will we roam from one thing to another in an endeavour to find answers to a variety of questions which are often asked.

Those interested in the science of astronomy have to take a lot of statements they read for granted, but would prefer to know why such and such a thing is the case.

They read that a certain planet or star is so many millions of miles away from us without knowing how such distances are measured. But they would like to know. They read of Kepler's Laws of Motions of the Planets but cannot understand them sufficiently to get a simple idea of how they affect planetary motion.

Then there is the science of Geography associated with maps, projections, globes, great and small circles and so on. These, in turn, are associated with parallels of latitude and how to find the shortest distance between two points on the earth's surface.

Others want to know why there could not be an atmosphere on the moon, what is meant by the specific gravity of the acid in their car battery, what is the meaning of the density of a substance and how useful is it to us to know.

It is unavoidable that we must use a little simple arithmetic in our explanations, but this will not be too difficult for even a novice. So we will proceed without further ado.

Let us start by talking about DENSITY. This is a matter which affects us generally because it affects manufacturers, builders, architects, refrigerator engineers and so forth.

The density of a substance is its weight per unit volume. It is expressed mathematically as follows:—

Density equals weight of substance/volume.

It can be seen that if we have a block of something which weighs 30 pounds and occupies a volume of one cubic foot then its density is 30 pounds per cubic foot because, using the formula, 30 pounds (its weight) divided by 1 (its volume in cubic feet) gives us an answer of 30.

The unit for volume can be cubic inches, cubic centimetres, cubic miles or whatever you like. The weight can b pounds, ounces, grams or any suitabl constant.

Different substances have widely different densities. Water has three densities depending on whether it is liquid vapour or ice.

As a liquid it has a density of 62. pounds per cubic foot. ice is 56.3, an water vapour .0806.

The density of other familiar substances are: iron 486 pounds per cubi foot, sandstone 140, balsa wood 10, rubber 66.7, gold 1211, petrol 49.4, cor 18.75; pine wood 31.2, brass 535, plat num 1345, hydrogen .0056.

PRACTICAL USES

DENSITY is very important to a architect because, by knowing the density or weight per cubic foot of buildin materials, he can calculate the require strength of foundations, trusses, floo and so on.

In the construction of dividing wal in buildings the problem sometim arises as to the adequate soundproofin between rooms. By knowing the density of various acoustic materials th right kind can be chosen in relation the strength of foundation.

It is equally important to an i manufacturer, because he can calcula the sizes of containers required to mal blocks of ice weighing whatever chooses, for whatever he wants to charg

Similarly, motor car manufacture can calculate the size of petrol tanks hold so many gallons of petrol.

A more convenient way of expressi density is the method of SPECIF GRAVITY. It will be seen that som confusion can exist in describing de sity because different countries will u different units of volume or weig Whilst we would say that petrol has density of 49.4 pounds per cubic fe people in France and other countr using the metric system would say th petrol has a density of .79 grams p cubic centimetre.

To avoid this and establish a univ sal constant the system of SPECIF GRAVITY was devised. This is defin as the ratio of a given volume of substance to the weight of an eq volume of water. Simply put, as an ample, it is merely dividing the weig of, say, a cubic foot of the substan by the weight of a cubic foot of wat

For instance we know that a cu foot of petrol weighs 49.4 pounds a a cubic foot of water weighs 62.5 poun Dividing 49.4 by 62.5 gives us .79 the specific gravity of petrol. This me that it is .79 as heavy as water.

These values have been calculated countless numbers of substances a tabulated for use in any country of world so that there can be no c fusion because of different units measurement.

Simple arithmetic enables, say, architect to calculate the weight o substance from knowledge of its spec gravity. Take sandstone for instance. specific gravity is 2.25. This means t it is 2.25 times as heavy as water a as water weighs 62.25 pounds per cu foot, sandstone must weigh 62.25 x 2

140 pounds per cubic foot.

The specific gravity of sulphuric acid higher than that of water, likewise e specific gravity of a combination of lphuric acid and water is higher than at of water.

In a car battery a solution of sulphuric id and water is used. When fully arged all the acid is in the water so at the specific gravity is higher. As battery discharges, the acid is ab-rbed by the battery plates and the ecific gravity of the solution becomes wer because it is nearly all water.

HE HYDROMETER

The hydrometer used to measure the ecific gravity of liquids is merely a ss float which sinks into the fluid ac-ding to the density or specific gravity the latter. The stem of the float is duated in various specific gravities.

Thus the specific gravity of a liquid that shown on the scale correspond- to the depth to which the hydrometer ks. Car battery acid has a specific vity of about 1.3 at full charge to 1.1 discharge. So much then for density specific gravity.

Let us now travel outwards into space the moon. The question often arises to why there is no atmosphere on the on when that body is so close to the th.

The answer to this one is explained re simply when we know the reason our earth maintaining its atmosphere. Our atmosphere is a gas consisting of lecules which are moving about at ex-nely high speeds. It has been cal-ated that the average velocity of an a molecule is about 1,600 feet per ond at 0 deg. centigrade.

We are not going to worry about ex-ne accuracy in our figures. A rough roximation is good enough for our poses in this case. Most of the energy he molecule is used up in overcoming force of gravity and the molecule s back to close proximity of the h.

OVE AVERAGE

t their average speed of travel these ecules flying vertically would reach a ht of no more than about 40,000 f. This calculation is for the average sd. But traces of atmosphere have n detected at heights of 300 miles or Why is this?

Whilst the AVERAGE speed is 1,600 feet per second the actual speeds individual molecules vary. Some go r, some slower. Some travel at ut 600 feet per second while a small-umber travel at higher speeds up to 00 feet per second.

he faster a molecule travels the high-t can go before it expends all its gy in overcoming the force of gravwhen it returns to earth.

bout 17 per cent of the air's mole-us travel at 600 to 900 feet per nd, 20 per cent travel at 900 to 0, 20 per cent to 1,500, 9 per cent l between 1,800 to 2,100, 8 per between 2,100 and 2,400, 1 per between 3,900 and 4,200 and only ry small fraction of 1 per cent travels peeds up to 11,000 feet per second. se figures explain why the air be-es more rarefied the higher one goes. hat the air at 300 miles is extremely fied because only a fraction of our molecules can get there.

r a molecule of oxygen, nitrogen arbon dioxide to escape from the earth's gravitational field altogether it would have to travel at a speed in excess of about 40,000 feet per second and as no molecules of the air travel at this speed it becomes clear why the earth is able to hold its atmosphere around it.

Now to get back to our Moon. The gravitational strength of this body is only one-sixth of that of the earth. For a molecule to escape from that field it would need to travel at a speed of only about 8,000 feet per second.

There is a law governing the distribution of velocity among gas particles which shows that as the fastest molecules escaped from the moon other molecules would acquire the critical velocity.

Thus more and more molecules would escape and the moon would gradually lose whatever atmosphere formed there. It has been proved mathematically that an atmosphere can only cling to a planet or other celestial body if the average speed of its molecules is one-fifth of the escape velocity.

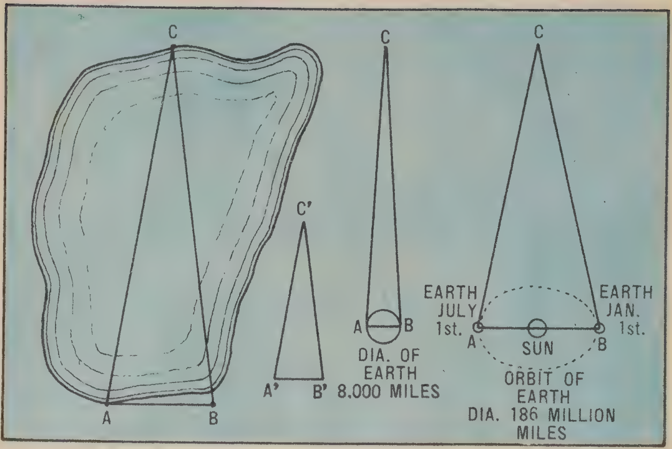
In the case of the earth the escape velocity is about 40,000 feet per second while the average speed of its air molecules is only about 1,600 feet, well within the escape velocity of 8,000 feet per second (one-fifth of 40,000).

On the moon, however, the escape velocity is only about 8,000 feet per sec. One-fifth of this is 1,600 feet per second, and as many molecules travel faster than this the air would soon travel out away from the moon.

While we are on the subject of celestial bodies we might as well see how distances to them are measured. This job is similar to that done by a surveyor who surveys, with a theodolite, over mountains, rivers, lakes, and so on. Notwithstanding that stellar distances are vast, it is not a job of any great magnitude.

Take a look at one of the diagrams given here and you will see that, if a surveyor wishes to measure the distance across, say, a lake, he first establishes a base line of any suitable length on the shore of the lake. This is represented by the line AB. He now sets up his theodolite at point A and measures through the sights the angle BAC. He does likewise with the angle ABC.

He now takes pencil and graph paper and draws to scale the triangle ABC with the correct angles he has ascertained. This is what is called "Triangulation." Having drawn the triangle to scale it is an easy matter to measure the length of the lines AC or BC or for any other point along the line AB


C
A
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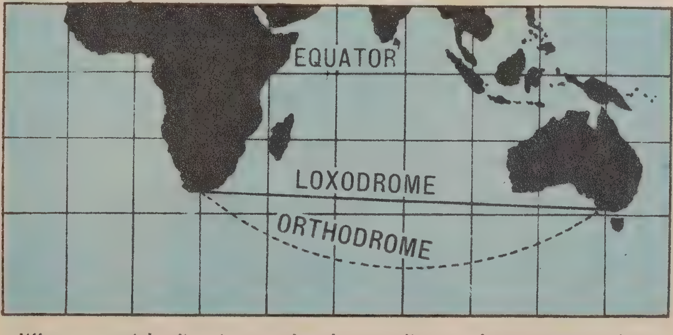
DIA. OF EARTH 8.000 MILES
C
EARTH JULY 1st.
EARTH JAN. 1st.
A
SUN
B
ORBIT OF EARTH DIA. 186 MILLION MILES

How far to a distant planet? Not a difficult problem really. The astronomer uses the same technique as does a surveyor when measuring the distance across a stream or lake. The earth's rotation on its axis or in its orbit is used to provide a base line.

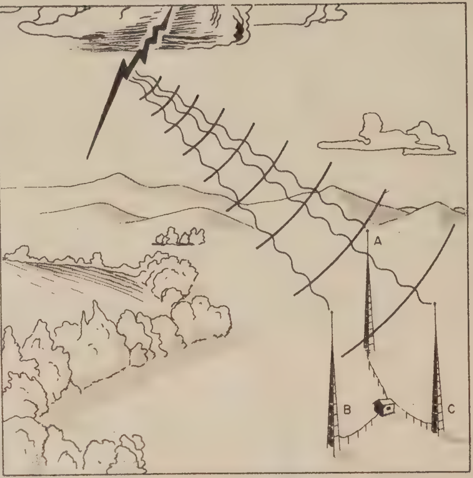


When a straight line is not the shortest distance between two points. Strangely enough, the shortest distance between the Cape of Good Hope and Adelaide is via the curved line, not the straight line.

"ELPHI" TRACKS ATMOSPHERICS

The United States National Bureau of Standards reports the recent development and installation of a new system for locating the source of natural static discharges or "sferics" as they have been dubbed. This information is invaluable to meteorologists and other workers.

A VERSATILE technique for investigating electromagnetic waves originating from lightning discharges ("sferics") has been developed by the Boulder Laboratories. "Ephi," the name for this new system which locates and analyses sferics, is capable of appreciably greater accuracy than direction - finding systems that have been used in the past.



Three aerials, spaced about four miles apart, feed signals to a central analysing point. Location of the signal source is determined by measuring the time differences between the three signals.

The experimental equipment for the Ephi system has been installed near Brighton, Colorado, by the Navigation Systems Section of the Radio Systems Division. The system was developed by G. Hefley, R. F. Lindfield, T. L. Davis, and R. H. Doherty.

The antenna system consists of three 125ft towers spaced about four miles apart, forming the vertices of an equilateral triangle. The signals received at each antenna are fed over coaxial cables to the central control station of the system. Here electronic equipment determines the relative difference in time of arrival of the sferic signal from each antenna, and, from this, the direction from the control station to the lightning source is automatically determined.

Since sferics travel with the speed of light and the antennas are so closely spaced, the differences in time of arrival at the three antennas are so small that they are measured in microseconds. The maximum difference in arrival time between the antennas at Brighton is only about 21 usec. The Ephi equipment can make such measurements of time difference with an accuracy of a small fraction of a microsecond.

In addition to determining the direction of arrival of sferic signals, the equipment counts the total number of sferics occurring in any desired time interval, and can count the number of sferics arriving from several different directions at the same time. The sferic waveform can also be photographed, either with still or motion-picture cameras, and the record retained for further detailed studies aimed at a better understanding of radio wave propagation as well as the nature of the lightning itself.

In addition to its value as a research tool, "Ephi" is potentially of value in tracking such severe weather phenomena as tornadoes and hurricanes. These storms are usually accompanied by sferics of high intensity which can be detected by the equipment.

The Ephi station at Brighton can pick up sferic signals originating in storms far offshore in the Gulf of Mexico or the Atlantic Ocean. Two such stations, located a few hundred miles apart, could accurately "fix" the position of a storm at distances of many hundreds of miles from either station.

---

to the point C. Any student of simple geometry could calculate the lengths mathematically.

The same system on an enlarged scale is carried out in measuring stellar distances. The base line in this case is the diameter of the earth. But the astronomer doesn't have to travel to the other side of the earth to do it.

A look at the other diagram will show the procedure.

The astronomer sets up his instrument at point A and sights the celestial body C, noting the angle made at A. He now waits for the earth to make one half revolution which is 12 hours later. This takes him half-way around the world in relation to the celestial body and thus gives him a base line of 8,000 miles. He sights the star again and notes the angle from this end of the base line to the star. Although he is still in the same town at A he is really 8,00 miles away at point B as far as the sta is concerned. He now joins up all th points and proceeds in the same way a the surveyor.

If the stellar distances are very gre he needs a longer base line. In this cas he uses the earth's orbit around the su as his base line. It would be obvious impossible for him (at present) to trav out into space with his instrument. I deed this is not necessary. All he do is to sight the star, from his roof to or observatory, note the angle, and the wait for six months. This takes him the other side of the earth's orbit whe he takes another sighting. This giv a base line of 186 million miles. H draws this to scale, extends the oth two sides of the triangle at the r quired angle and there we are. Th diagram explains all.

NAVIGATION PROBLEM

Coming back to earth, what is t shortest distance between two points the earth's surface? Is it a straight lin On a plane surface the shortest distan between two points is certainly a strai line—unless you are taxidriver. Th the shortest distance is a very cur line indeed.

But the surface of the earth is no plane surface. It is curved, and t makes all the difference.

Because the earth is a sphere it most difficult to draw its geography o flat piece of paper. Many attempts ha been made and we have had all kinds maps over the centuries. About the o flat map that has survived for use mariners is that known as Mercato Projection, where the meridians and l tudes are shown as parallel straight li at right angles.

A straight line between two points Mercator's Projection is called a "Lo drome" while a curved line is an " thodrome."

If you were a captain of a vessel sea you would want to know the sh est distance between two points, so get out your Mercator's map and d a straight line or loxodrome betw the two points. Now if you wer bad captain you would sail strai along that line and travel many m further than you should have done. you were a good captain you w know that the shortest distance is along the loxodrome as shown on map but along the curved line or or drome, which a good mariner knows h to draw on his flat map.

NOT WHAT IT SEEMS

If you look at the diagram gi elsewhere you would naturally th that the shortest distance between Cape of Good Hope and Adelaide Australia is along the straight line. T two places are almost on the same pa lel of latitude. You would think the shortest way from one place to other on the same latitude is along latitude. You would be greatly taken.

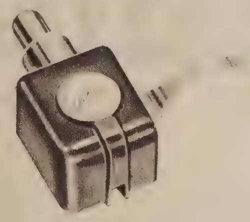
In our diagram the shortest way f the Cape of Good Hope to Adelaid along the curved line or orthodrome

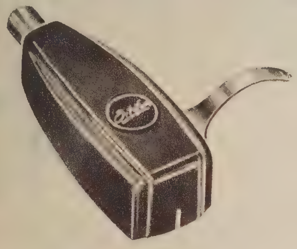
As we are now about to go over globe in order to explain the above se ing paradox we will have to unders the meaning of the terms Great C and Small Circle.

On a Globe of the World a great c is any circle drawn on its surface

(Continued on Page

ACKNOWLEDGED THE WORLD'S FINEST...


SPU cartridge fitted in A type shell.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- Model 8060. Secondary Impedance: 600 ohms.

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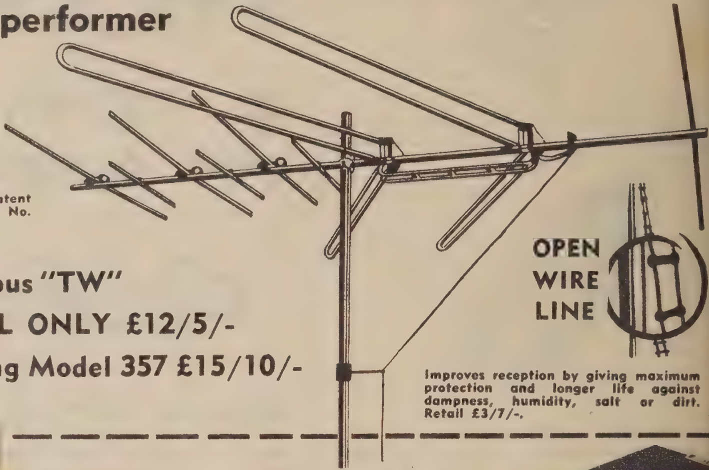

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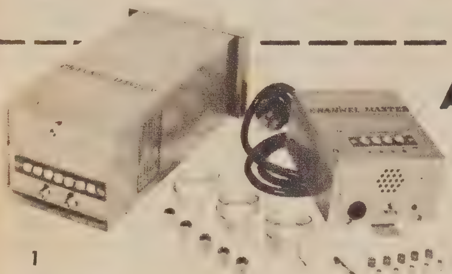

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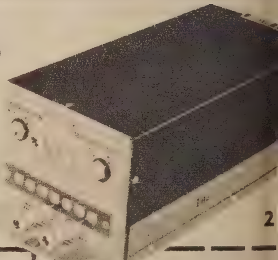

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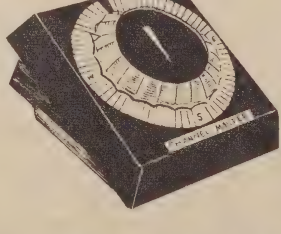

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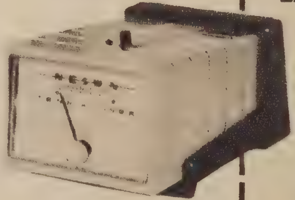

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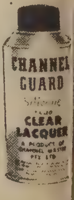

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"DOCTORED" WATCH KEEPS CHECK ON HEART BEATS

Marlene Johnson, a secretary in the Palo Alto scientific research laboratories of Lockheed Missiles and Space Division, demonstrates the Heart Beat Totaliser, which appears to be an ordinary wristwatch with a wire disappearing into her sleeve.

Her wristwatch won't give the right time, and there are two small wires running up her arm. But she can probably tell you how many times her heart beats a minute, and just when it is thumping the most.

HE" just happens to be a staff member wearing a new portable gadget own as a Heart Beat Totalizer, developed by the Lockheed Aircraft Corp., two San Francisco heart specialists. By ingenious but simple conversion of inexpensive wristwatch, and by wiring watch to a tiny amplifier weighing ly one ounce, research scientists at the lo Alto, Calif., laboratories of Lockd's Missiles and Space Division, have duced an accurate and convenient way measuring a person's heart beat night d day, while the wearer continues his mal way of life.

Previously, the changing rate of the rt beat could readily be measured ly while the subject was in bed or next to bulky instruments. But the l value of the portable Heart Beat talizer, Dr Meyer Friedman and Dr y H. Rosenman believe, will be in its "talizing" of a person's heart beat ile he is working at his office k or running for the bus, and while is doing her housework or screaming at the children!

OVERNMENT SUPPORT

r Friedman is director of the Harold inn Institute of Mount Zion Hospital and Medical Centre, San Francisco, Dr Rosenman is director of the Institute's department of physiology. The titute, devoted to heart research, is nced by the U. S. Federal Government, the American Heart Association local heart groups.

r Friedman and Dr Rosenman are ely recognised by the medical profession throughout the United States for r studies of heart disease. They are ing spokesmen for the position that ss is the basic cause for most heart ase — that stress is the underlying se for abuse of arteries and the heart.

oreover, Dr Friedman points out, hin the past 10 years drugs have been eloped which will effectively relieve pressure brought by mental and emotial stress on arteries.

creased heart beat produced by busi- and home-life stresses, Dr Friedman says, may be a direct cause of strain to the blood vessels. When, therefore, in a man's daily life does his heart pick up tempo? That's where the Heart Beat Totalizer comes in.

To obtain a simple, portable instrument which will measure heart beat, Dr Friedman went to Lockheed, whose research laboratories in the San Francisco area are among the largest in the world.

Lockheed management, which had already assisted heart researchers in other studies, and which is itself vitally interested in heart research as related to its "man-in-space" projects, put company scientists on the job.

The assignment was to produce a heart-beat measuring device which a man could wear painlessly and inconspicuously day and night for a period of three days.

The job went to Lockheed's Department of Communications and Controls Research, which occupies most of its time with such matters as communications between satellites and the earth, the measurement of infra-red radiation, and missile and oceanographic instrumentation.

Three of the Heart Beat Totalizers have been delivered to Dr Friedman, and pronounced totally satisfactory, except for one bug — an electric shaver will interfere with the heart-beat count, and the electrical interference caused by the ignition system in some older model cars is also stronger than the heart voltage.

The solution to the shaver problem is simple: people wearing the Totalizer will be told not to use an electric shaver. Lockheed and a garage mechanic friend of Dr Friedman are working on the ignition interference created by some cars (specifically Dr Friedman's).

The use of a wristwatch may suggest that the Totalizer measures the pulse. But this is not true. A pocket watch or pin-on-watch could be employed just as well. The wristwatch was chosen for the convenience of the wearer.

How does the Totalizer work?

Two electrodes, pieces of lead foil about the size of a postage stamp, are taped to the chest. From each electrode comes a small wire, and these wires connect to a battery-operated amplifier which is so compact that it is smaller than a pack of gum and can be clipped to a man's undershirt.

SIGNAL VOLTAGES

The beating heart produces very weak voltages across a persons chest. This voltage is increased in strength by the amplifier. The amplified voltage is then transmitted by a thin double-wire to the wristwatch.

The balance wheel of the watch was removed, and in its place a tiny electromagnet was substituted. This electromagnet, powered by the voltage from the heart-beat amplifier, operates the escapement mechanism of the watch, causing the second, minute and hour hands to move.

One hundred and fifty heart beats will move the second hand of the watch one full circle. For the minute hand to make a full circle, 9,000 heart beats are required, or 150 x 60.

To tell how fast his heart is beating during certain periods of the day, the wearer will compare his heart-watch to a watch or clock which has not been tampered with.

He may find, for instance, that there were 5,000 heart beats in one hour of actual time, and 6,000 in the next. What he was doing during those two hours — perhaps snoozing at his desk the first hour, and working on his income-tax the second hour — caused the rate of his heart beat to change.

What does what, and to which kind of people, is what Dr Friedman and Dr Rosenman expect to learn from the Heart Beat Totalizer.

GLASS fibre mats are being used in America for erosion control, to hold soil in place until vegetation can grow up.

The mats are made of textile-type fibres lightly bonded with plastics and are staked in place on land subject to washing, such as drainage ditches or rodside verges. Heavy rain, repeated freezing and running water are claimed to leave the soil beneath undisturbed. Meanwhile, enough sun and air penetrate the mat to encourage plant growth up through it.

The maker claims that the mats are completely free from corrosion or rot because they are inorganic. Their cost is said to be much lower than that of concrete used for drainage ditch linings.

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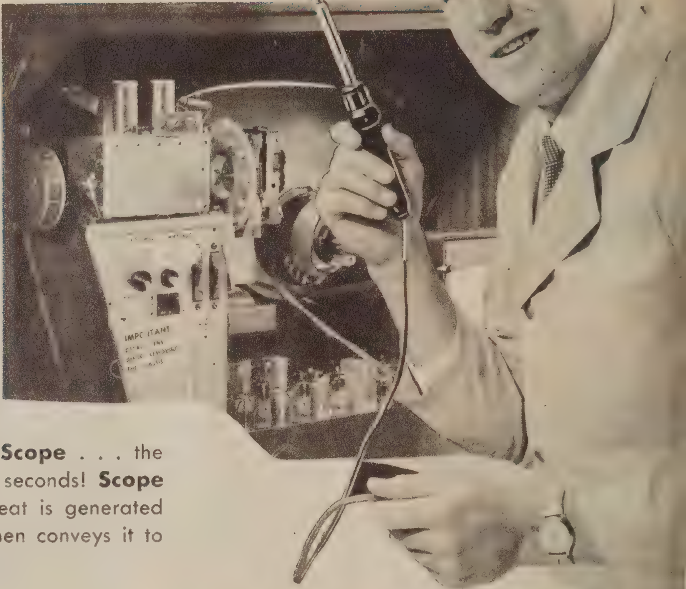

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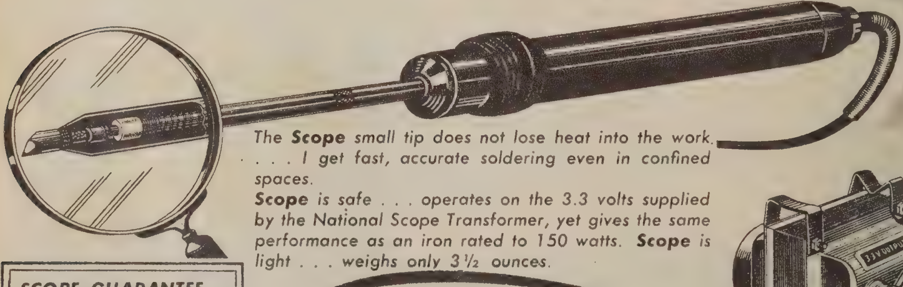

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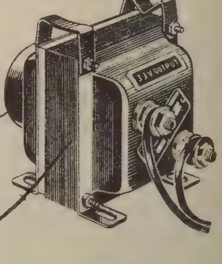

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Technical Review

TV FIELD FREQUENCY STANDARDS CONVERSION

A few years ago BBC engineers achieved the "impossible" by successfully converting TV images from one line standard to another. More recently, the advent of video tape recordings has raised the problem of frame standards conversion; from the 50 cps of Britain and Europe to the 60 cps of the U.S.A. Once again BBC engineers provided the answer.

CONVERSION of television pictures from one standard to another has been common practice for a number of years, and has made possible the Eurovision link. However, conversion of European standards, which all employ a 50cps field frequency, to the 525-line 60cps system in use in North America, and vice versa, has set a new problem.

In addition to the relatively easily removed moire pattern, caused by the interaction of closely related line-structures, a new type of picture deformation becomes apparent. The different field frequencies interact one with the other to produc a 10cps amplitude modulation of the video signal, which appears as a flicker at this frequency, and which renders the converted picture intolerable to the viewer.

Equipment designed to overcome this problem has been developed by the B.B.C. Engineering Division and has already been used to handle recordings, for translation to the American standard, of the Paris Summit Conference and the wedding of H.R.H. Princess Margaret.

The principle of a standards converter is shown in diagrammatic form in Fig. 1. The incoming video signal is amplified and displayed on a high-quality cathode-ray tube which has an afterglow time constant of 7msec. A lens focuses the displayed picture on to the storage mosaic of a camera tube scanned at the rate corresponding to the new standard, the output of which is processed in a sync-pulse insertion and blanking unit. The signal emerging from this unit is the converted signal.

As has been mentioned, when the number of lines per

Fig. 2. Showing how a 10 cps flicker is created when converting from 60 cps to 50 cps (or vice versa). The effect is quite intolerable to viewers.

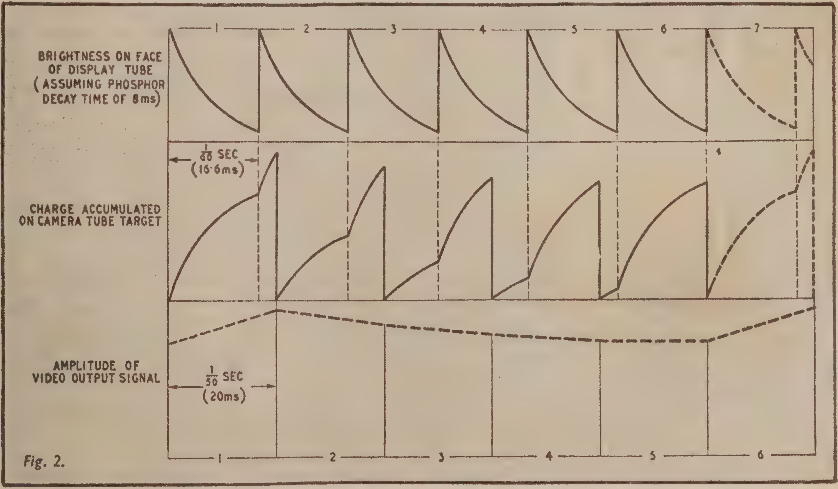
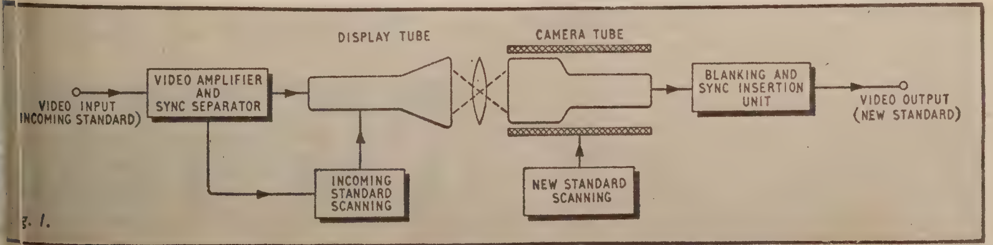


Fig. 2.

☆

Fig. 1. The basic principles of standards conversion. Many refinements are necessary to minimise interference effects arising from the differing standards.


DISPLAY TUBE
CAMERA TUBE
VIDEO INPUT (INCOMING STANDARD)
VIDEO AMPLIFIER AND SYNC SEPARATOR
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BLANKING AND SYNC INSERTION UNIT
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Fig. 1.

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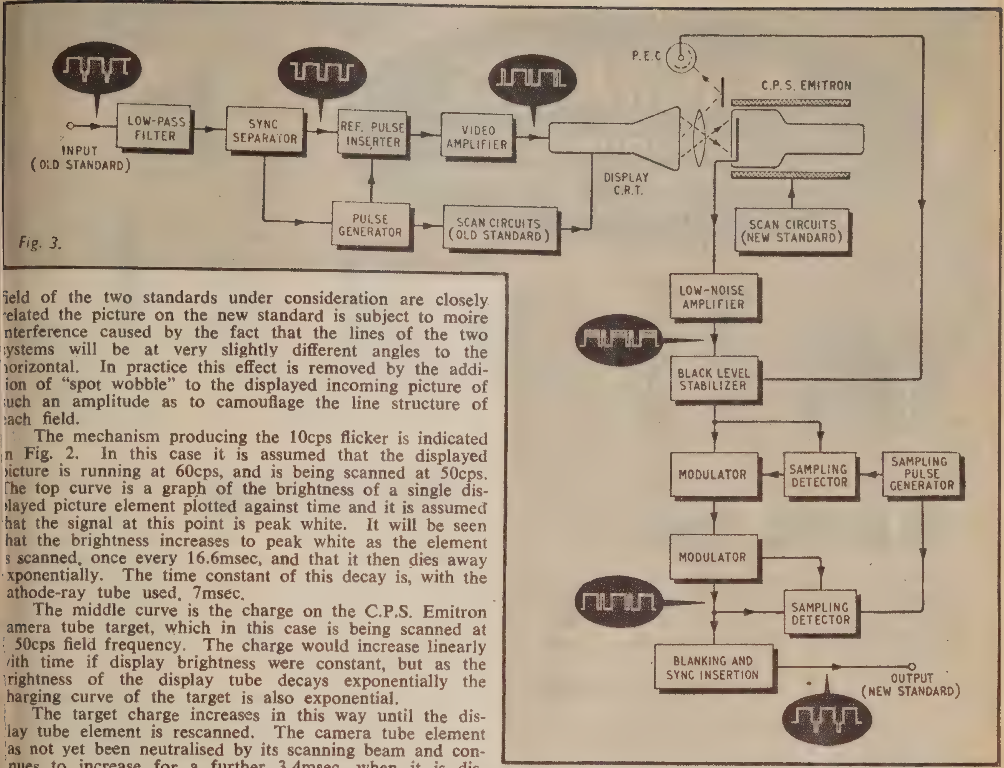

Fig. 3.

Fig. 3. A block diagram of the BBC 50 cps-60 cps converter, showing units concerned with flicker removal. Waveforms shown are peak white lines.

ield of the two standards under consideration are closely elated the picture on the new standard is subject to moire nterference caused by the fact that the lines of the two ystems will be at very slightly different angles to the orizontal. In practice this effect is removed by the addiion of "spot wobble" to the displayed incoming picture of uch an amplitude as to camouflage the line structure of ach field.

The mechanism producing the 10cps flicker is indicated n Fig. 2. In this case it is assumed that the displayed icture is running at 60cps, and is being scanned at 50cps. he top curve is a graph of the brightness of a single dislayed picture element plotted against time and it is assumed hat the signal at this point is peak white. It will be seen hat the brightness increases to peak white as the element s scanned, once every 16.6msec, and that it then dies away xponentially. The time constant of this decay is, with the athode-ray tube used, 7msec.

The middle curve is the charge on the C.P.S. Emitron amera tube target, which in this case is being scanned at 50cps field frequency. The charge would increase linearly ith time if display brightness were constant, but as the rightness of the display tube decays exponentially the harging curve of the target is also exponential.

The target charge increases in this way until the dislay tube element is rescanned. The camera tube element as not yet been neutralised by its scanning beam and connues to increase for a further 3.4msec, when it is disharged. It now commences to charge again, but at a lower ate, as the display tube element brightness has decayed om its peak level.

The action continues in this manner until the fifth amera tube scan, when the two scans are once more coincient. If the peaks of the target charging curve are joined, sawtooth type of waveform is obtained at a frequency of 0cps and this is proportional to the output of the camera ube. The signal is thereby amplitude modulated at 10cps.

ULSE SAMPLING SYSTEM

Removal of this flicker is effected by a pulse-sampling, anually adjusted amplitude compensator, followed by an tomatic compensator which removes any flicker remaining ter the signal has been subjected to the effect of the anually set circuit. The system, which is the subject of ritish Patent 801140 (T. C. Macnamara and A. M. ooner), operates in the manner indicated in Fig. 3. The coming video signal is passed through a low-pass filter hich is switch-selected to pass the band of frequencies ed by the incoming standard (3Mc/s for 405-line 50c/s andard).

The next process is the insertion at the end of each e of the picture of a reference pulse which has a width about 2 per cent of the line period, and an amplitude of out 85 per cent peak white. The pulse slightly overlaps e right-hand edge of a line of video signal and is apparent a bright vertical stripe on the picture. The video signal th the reference pulse added is now amplified and disayed on the cathode-ray tube. The conversion process ferred to earlier takes place and the 10cps amplitude odulation of the signal is also impressed on the reference lse.

The voltage developed across the C.P.S. Emitron outt resistor consists of the wanted video signal—propornal to the target discharging current—and also, the tube ng a photo-electric device, a signal which is proportional the total light emitted by the display tube. To cancel effects of this latter unwanted signal, a photo-cell views display screen through an angled mirror, the output ng again proportional to the total light on the screen. e signal is amplified and applied to the black-level stabilising unit, where it is subtracted from the output of the camera tube. The signal remaining after subtraction is then the video waveform alone.

After amplification and black-level stabilisation the composite video signal and reference pulse is fed to the two compensators. A sampling pulse is generated at line frequency to coincide in time with the reference pulse and used to operate a sampling gate. The varying amplitude of the reference pulse is sampled in the gate and a correction signal related to the envelope of the references pulses is derived, being used to drive a modulator which is in series with the signal path. The manual gain control adjusts the correction signal until the flicker is at minimum level. After this compensator the signal passes through a similar circuit which functions as an AGC.

After passing through a modulator the signal feeds the sampling gate, which then applies the derived correction signal to the series modulator. The whole circuit is a feedback loop and is capable of reducing amplitude variations at 10 cps from 30 per cent to less than 1 per cent.

SUMMARY

In summary, then, the signal first passes through a manually adjusted compensator, which reduces the level of modulation to a value which is within the range of control of the automatic circuit.

On leaving the two compensating circuits the signal is processed in a unit which inserts synch pulses and blanking intervals and in which the reference pulses are removed. The signal is now converted to the new standard and is ready for use.

(From "Wireless World.")

[Editorial note: The same problem will apply should Australia desire to exchange video taped programs with either U.S.A. or Japan, since both use the same line and frame standards. With the increasing use of video tape in all countries, the difference in standards is the main barrier to the exchange of programs in this medium.]

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(Radio, T.V. and Hobbies, June, 1961.)

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NEW APPROACH TO DIRECT CONVERSION OF HEAT INTO ELECTRICITY

Scientists in all parts of the world are currently seeking the best means of converting heat directly into electricity. On July 1, 1960, the Academy of Sciences held a meeting in Paris that may become historic. That day Francis Perrin, High Commissioner of Atomic Energy, read a note by Siegfried Klein entitled modestly, "Obtaining a Direct Current of Electricity from an Ionised Gas or Vapour."

By E. Aisberg*

SIEGFRIED KLEIN is far from being unknown among electronics people. He has been known for several years as he inventor of the first loudspeaker, without a membrane, in which the sound waves are generated by vibrations of molecules of an ionised gas—the Ionohone.

One of the classic problems in the omain of energy is that of converting eat directly into electricity. The method sed at present in atomic reactors appears thoroughly barbarous in the eyes f scientists. Between the calories that nter and the output watts from an tomic converter one finds several intermediary conversions. The heat boils water or heats a liquid metal. The apour produced operates turbines that rive electrical generators. We can see ow little logic there is in this and how rgent it is to find a direct method of onverting heat into electricity.

HEAT IONISES GAS

In one type of heat-to-electricity conerter — the MHD generator — heat nised a gas, producing a plasma. At gh temperatures, the extremely rapid ovement of molecules produces imerous collisions between them. Some oms are broken into two parts—a positive ion and a negative electron.

By passing a jet of plasma through a agnetic field, we can separate the negative and positive charges, for the field pels them in opposite directions. They e then directed toward two electrodes hich become the terminals for the ectromotive force.

Siegfried Klein works with the same nised gas. But he separates the oppoe charges without using any deflecting ld, magnetic or electric. And it is in is that his invention is remarkable.

The following is a summary of Siegied Klein's paper.

We have been able to establish an portant separation of positive and gative electric charges in a jet of nised vapour, metallic or otherwise. is separation of charges is obtained hout applying a magnetic or electric d in the vicinity of the collecting elecdes.

The experimental equipment shown s mercury vapour. The setup consists a glass vessel whose base forms a ervoir containing a certain amount of rcury. This reservoir has a vent (2) its top and a tube (5) connecting the per portion to the base. This section ends upward as a glass cylinder with tallic electrodes (3) and (4). The er portion of the reservoir is encled by a coil through which a 40-mc rf current flows to ionise the mercury vapour. Before being put into operation, the apparatus is evacuated to a pressure of about 10^{-3} millimeter of mercury.

Once ready, the device is placed over a Bunsen burner and the mercury brought to a temperature of several hundred degrees centigrade. Because of this heating, the mercury-vapour pressure in the reservoir rises to several centimetres of mercury and a powerful jet of vapour, ionised by the 40-mc field and carrying about 1 gram of mercury per second, traverses the vent and the electrodes.

These vapours condense in the upper portion of the apparatus, where there is a vacuum in the order of 10^{-2} millimeter of mercury. The condensed mercury descends through the tube (5) into the base of the reservoir.

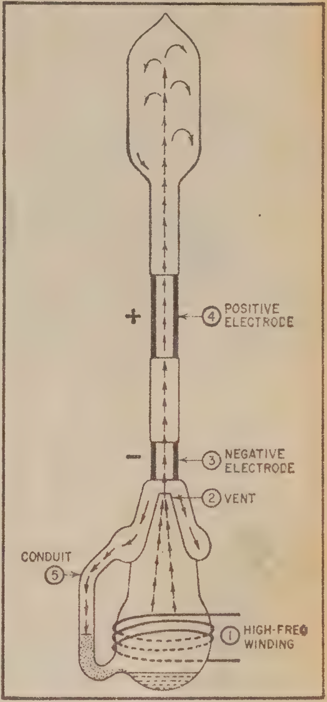
Experiments show that a continuous emf of approximately 10 volts appears between electrodes (3) and (4). The characteristic of output voltage vs load is that of a battery having in the most favourable case an internal resistance of about 50 ohms. The value of the emf is within large limits independent of the high-frequency power absorbed in the process of ionising the mercury vapour. Varying the degree of ionisation, on the other hand, modifies the amount of current collected between the electrodes.

The current also depends on the amount of ionised fluid that traverses the equipment. For no load it starts from zero and increases rapidly. It reaches a maximum and then starts to decrease again, the flow of mercury continuing to rise. This fact is important, since it demonstrates that for a low degree of ionisation of the vapour it is possible to obtain relatively strong currents. The amount of rf power absorbed increases directly with vapour flow.

It is worth noting that electrode (3) is near the vent and is always negative with respect to electrode (4). If more than two electrodes are placed in the path of the vapours, there is always 10 volts between two successive electrodes. Everything takes place as if two comparable electric generators were hooked up in series.

A slight cooling of electrode (4) facilitates the condensation of ionised vapour and influences current strength favourably. Other things being equal, if electrode (3) is at 350 deg. C and electrode (4) at 80 deg., the emf is 10 volts and the internal resistance 15 ohms. If, on the other hand, electrode (3) is at 350 deg. and (4) is 150 deg. C, emf remains the same and resistance rises to 30 ohms.

No exact explanation of the phenomenon that causes this separation of electric charges under the conditions described can be given at present.



Siegfried Klein's experimental converter for producing direct current from heat. An explanation of its behaviour is given in the text.

We believe that the separation occurs because the fluid formed of molecules, ions and electrons, in traversing the equipment at a high speed and penetrating afterward into a zone of low pressure, diffuses in an unequal fashion. The more mobile electrons reach the first electrode more rapidly and the ions and droplets, because of their greater mass, travel farther and condense on the farther electrode (4).

We have repeated the same experiment using water in the place of mercury. We got 90 volts instead of 10, but the internal resistance of the source of voltage is considerably greater. It seems that there is a relation between the emfs of voltage sources of this type and their internal resistances.

We believe that such a device could convert heat to electricity, assuming that the cesium vapour or other substances could be ionised by heat, for example by contact with a surface at high temperature.

To determine the yield of this kind of apparatus, we used a high-frequency source of energy that heated the mercury with eddy currents and ionised the gas and have found, up to the present, a yield up to 12 per cent.

— From "Radio Electronics."

---

*Director, Toute la Radio, Paris, France

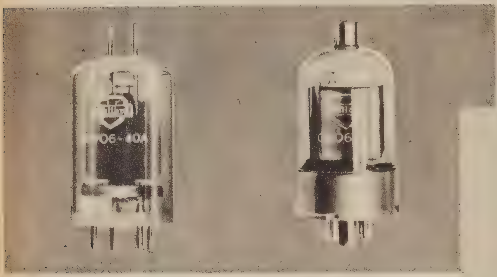
V.H.F. POWER TETRODES

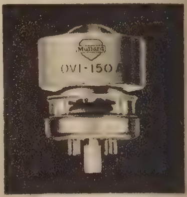
FOR F.M. AND TELEVISION TRANSMITTERS

Transmitter designers are now offered a complete range of V.H.F. tetrodes by Mullard.

These high efficiency, high gain tetrodes make possible the design of transmitters with fewer valves and, consequently, reduced initial cost.

The higher overall efficiency of equipment fitted with Mullard tetrodes results in lower running expenses — a factor in the growing popularity of these valves in the world market. Further details of these tetrodes and other Mullard valves and tubes may be readily obtained from the address below.





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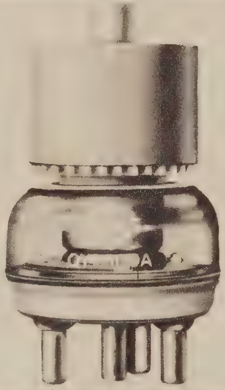

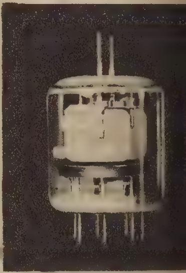

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MULLARD TYPE No.	AMERICAN TYPE No.	CV TYPE No.	DESCRIPTION	BASE	HEATER (V)	HEATER (A)	Va max. (V)	pa max. (W)	TYPICAL LOAD POWERS AND FREQUENCIES (W)	(Mc/s)
QV06-20	6146	CV3523	V.H.F. Power Tetrode	Octal	6·3	1·25	600	20	52 25	60 175
QV1-150A	4X-150A	CV2519	V.H.F. Power Tetrode	B8F	6·0	2·6	1250	150	195 140	165 500
QQV03-20A	6252	CV2799	V.H.F. Power Double Tetrode	B7A	6·3 12·6	1·3 0·65	600	2 x 10	48 20	200 600
QQV06-40A	5894A	CV2797	V.H.F. Power Double Tetrode	B7A	6·3 12·6	1·8 0·9	600	2 x 20	90 60	200 475
QY3-125	4-125A	CV2130	V.H.F. Power Tetrode	B5F	5·0	6·5	3000	125	375	120
QY4-250	4-250A	CV2131	V.H.F. Power Tetrode	B5F	5·0	14·0	4000	250	1000	75
QY4-500A	4X-500A	—	V.H.F. Power Tetrode	—	5·0	13·5	4000	500	900	110
QY5-3000A	6076	—	V.H.F. Power Tetrode	Special 4-pin	6·3	32·5	5000	3000	4100 2600	75 220

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MT96

SCIENTIFIC & INDUSTRIAL NEWS

HIGH TEM. LUBRICANTS

A NEW series of high temperature lubricants and hydraulic fluids, w ch are said to be capable of operati at temperatures of up to 900 degrees F renheit without decomposing, has b n developed.

At the same time they are said to h e unusually good lubrication characte stics.

Their viscosity indices are said to be a east as high and in many cases higher t n those of the best conventional lubric ts. They are also said to be between o and five times more stable than most o er synthetic lubricants under exposure t nuclear or radioactive radiation.

They can also be "tailored" and blende to provide optimum lubricant properti far more readily than most conven nal synthetic lubricants. The operat n of the new lubricants and the h draulic fluids, is based on the use of series of new polyphenyl ethers.

Monsanto Chemical Company, 10-18 V ctoria Street, London, S.W.1, Engl d.]

SILICONE RUBBERS

TWO new types of silicone rubber have been developed in Britain. One o these is said by the scientists respons le for developing it to be especially u eful for high temperature sealing, p tching, caulking, potting, and for the e capsulation of sensitive electronic de ces.

It can be applied by spraying on — w en it has been dissolved in a solvent — or it can be applied by means of a d pping process. Initially it is a white s lvent-free paste and has the advant e that it cures at room temperature form a resilient silicone rubber after e appropriate curing agent has been dded.

The second silicone rubber compound "thixotropic" and can therefore be pplied exceptionally efficiently from a ulking gun. It can be readily bonded primed metal surfaces, and like the revious compound can be cured at room mperature. It is said to be especially itable for sealing, patching and caulk g, where these conditions are applic le.

[Imperial Chemical Industries, I.C.I. ouse, Millbank, London, S.W.1, Eng nd.]

EW ELECTRONIC PAPER

SUITABLE for use with conventional industrial recorders, a new kind of aper is claimed to be capable of pro ucing a "trace" or graph even when e voltage which passes through the re ording electrode or "pen" is very low.

The German manufacturer says that, s with other similar papers, the current hich passes through the electrode auses a chemical reaction in the aterials attached to the back of the aper. The difference lies in the emicals and pigments used.

With the new paper, graphs and mark gs can be seen in the dark, and the hemical processes leave very little esidue, which means that the pen re ains clean and short circuits are un kely to occur.

The paper, coated with material that prevents it from sticking to itself when used in tropical or damp climates, is said to be particularly suitable for use with echo-sounding equipment such as that used in the fishing industry. It makes it possible to detect weak echoes and, because of this, is able to differentiate, for instance, between a shoal of fish on the sea bed and the sea bed itself.

[Renker-Belipa G.m.b.H., Lendersdorf-Krauthausen, Duren, Germany.]

POWDERED METAL SHEET

POWDERED metal sheets are being made in a continuous roll by means of a method devised by an American research institute.

The powdered metal is suspended in a viscous liquid to form a thick slurry and is passed through a sintering furnace in a continuous stream. Sintering vaporises the liquid and solidifies the powder, which retains its sheet form as it is re-heated and rolled to the required density.

It is stated that the process enables production of long sheets of alloys or exotic metals which could otherwise be produced only as small components.

[Powder Metallurgy Laboratory, Stevens Institute of Technology, Hoboken, New Jersey, U.S.A.]

MORE APPLES

TO produce an annual crop from apple varieties which ordinarily bear well only in alternate years, an American farm chemical company has developed a special chemical spray.

Some of the most popular apples have this alternate year characteristic and orchard owners have had to duplicate plantings to ensure a normal annual crop.

The new spray, described as a polyhalogenated benzoic acid, is applied during the fruit-producing stage in the productive year and is said to bring forth a good crop the following season. The spray has been patented.

[Amchem Products Inc., Ambler, Pennsylvania, U.S.A.]

SOLDERING ALUMINIUM

A SOLDER has been developed for aluminium and its alloys, which needs no flux or any special pre-treatment of the metal and which can be applied with an ordinary soldering iron.

The solder will flow and tin aluminium when the metal reaches a heat of about 180 degrees Centigrade and the manufacturers claim that it then alloys itself with the aluminium. It will also join aluminium to most other metals including molybdenum, stainless steel, copper, brass and some ceramics.

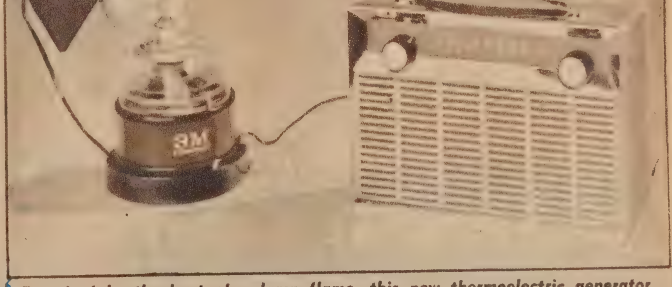
[Industrial Synthetics, 64 Marlborough Grove, London, S.E.1, England.]

CHEAPER ACETYLENE

A NOVEL process for producing acetylene from natural gas has been developed. It is claimed that the power used during the process is reduced by at least 20 to 25 per cent.

At the same time the process is said to operate far more effeciently than any

EMERGENCY LIGHT POWERS RADIO



Energised by the heat of a lamp flame, this new thermoelectric generator (left) provides enough power to operate a transistor radio. Such receivers normally require from 3 to 9 volts for their operation. The generator is envisaged as an alternative method of powering radios in emergencies which might arise from atomic war.

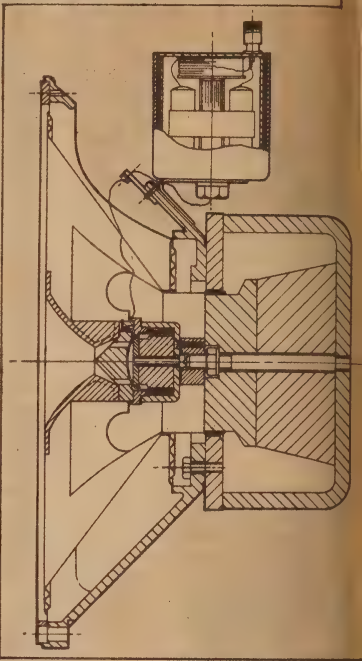
TRIAXIOM 3 IN 1 LOUDSPEAKERS

Goodmans Triaxiom series: These superb 3 in 1 speakers are designed for every pocket. Very wide frequency range, with exceptionally low distortion.

General Specifications

Frequency Range:	30—20,000 c.p.s.
Impedance:	15/16 ohms.
Coil Diameter:	3" Bass and Mid-range 1" (Aluminium) H.F. Pressure Driver
Electrical Crossover:	5,000 c.p.s. twin half section L.C. network 12 db/octave
H.F. Balance Control:	constant impedance wirewound L-pad, 0-15 db.

TYPE	SIZE	POWER HANDLING CAPACITY	FUNDAMENTAL RESONANCE	MAGNET WEIGHT	TOTAL FLUX	BAFFLE HOLE	¼" BOLT CIRCLE DIAMETER
412	12	20 watts	35	3½ lbs.	240,000	11"	11¾"
415	15	20 watts	25	3½ lbs.	240,000	13"	14 9/16"
615	15	25 watts	25	6 lbs.	308,000	13"	14 9/16"



THE UNIQUE TRIAXIETTE/TRIAXIOM 208

This is an 8" unit which has been developed to meet your need for a small unit with design and performance normally found only on larger and more expensive multi-way systems. The 208 comprises three concentric radiators; the bass and mid-range diaphragms are driven by a 3" diameter voice coil and employ mechanical crossover; at 5,000 c/s. a built-in electrical crossover transfers the signal to a pressure driven horn loaded high frequency unit. The magnetic energy for both air gaps is provided by a high efficiency slug magnet with an exclusive concentric gap system developed by Goodmans. Constant impedance continuously variable L-pad automatic control complete with knob and escutcheon is supplied, wired to the loudspeaker for treble output adjustment.

SPECIFICATIONS

Frequency Range: 40—20,000 c/s.

Fundamental Resonance: 45 c/s.

Max. Power Handling Capacity: 10 watts, 20 watts U.S.A.

Total Flux: 178,000 Maxwells

Voice Coil Diameter: (Bass and Mid-range) 3"

Voice Coil Diameter: (H.F.) 1"

Impedance: 15 ohms at 400 c/s.

Baffle Hole Diameter: 7"

Mounting: 4 holes, 9/32" diameter on 7⅝ P.C.D

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in resent day use. This is important be use acetylene is one of the major ra materials for the chemical industry.

e operation of the process depends on he use of a special electric cracking pr ess. It also depends on the use of a e-heating treatment when the natural ga which consists mainly of methane, is he ed up to temperatures of from 800 to 00 degrees Centigrade. After this or heating treatment, it is then subjected o thermal cracking.

he Moscow State University (Profes-sc Ye N. Yeremin and N. I. Kobozoe) M cow, U.S.S.R.]

CAR FENDERS

LUMINIUM car fenders and trimmings having a lustre that is said to co pare favourably with chromium-pl ed materials are now being produced b a Swiss firm.

his has been made possible by coverin ordinary commercial grade aluminiu sheeting with a similar alloy made w very pure aluminium.

he composite material is given a se es of special treatments which in-c le heating for eight hours at 420 d rees Centigrade, hot and cold rollir heating to 520 degrees Centigrade a "aging" for three days. Apart from li re, the treatments are said to give st ngth and flexibility.

Aluminium-Industrie A.G. Chippis (lais), Switzerland.]

COLOUR ANALYSER

COLOUR computer which can analyse colours and register t ir values in both figures and graphs v hin two minutes has been introduced i Japan.

For the measurement of colours, the s ctral method has been the most rel ble to date, but it needed hours of h man labour to finalise the figures. E en an electronic computer, it is rep rted, required 30 minutes to read the d ta.

The new colour computer, which is c scribed as a combination of spectrop oto-meter and electronic computer, is s d to be able to accomplish the entire p cess of reading, analysing and regist ing in only 60 seconds.

[The Tokyo Shibawa Electric Co., 2 nza Nishi, 5-Chome, Chuo-Ku, Tokyo, pan.]

NEW METAL DRILLING PROCESS

REMARKABLE new drilling process is now available as the result an American invention. It can drill rough metals previously impossible to ill without frequent removals and rewals of the drill. Two inches of one ch metal, the German A.T.S. 113, was illed through by the new process in ss than a minute at a demonstration.

The drill starts in manufacture as a ainless-steel tube with a small hole rough the middle. This is given ordiny twisted flutings without any relief. he bit end has then inserted in it a ngsten carbide strip, from which the int and the clearing edge of the drill e formed. Ordinary cooling fluid is mped at a pressure of 400lb per uare inch through the drill and so the p remains cool.

Furthermore, the angles of the end rinding are such that continuous spiral warf is not produced but instead a ries of small chips.

[Cold Point Drills Limited, 49 St. James's Street, Piccadilly, S.W.1, England.]

INDUSTRIAL PROCESS

A NOVEL method of recording the changes of temperature and pressure which occur during industrial processes has been developed in Germany. The changes are plotted with the aid of a stylus as usual, but the familiar continuous roll of graph paper is replaced by individual cards. These are fed continuously into the recording machine.

Once the information has been recorded on the cards, they are assembled and passed through a perforating machine. The positions of the perforations correspond to the outline of the graph.

According to the designer, the advantage of the system is that it cuts out the step of taking average values from the continuous chart and transferring them to the punched cards. The whole operation is therefore considerably speeded up and errors cannot creep in.

[Licentia Patent Verwaltungs G.mb.H., 1 Theodor-Stern-Kai, Frankfurt am Main, Germany.]

RESISTANT PLASTIC

A NEW plastic compound based on the use of a series of silicate polymers has been developed. Materials derived from it are said to show exceptional resistance to organic solvents, acids, alkaline compounds and other chemicals which attack plastic materials.

At the same time tests carried out with the new materials are said to have shown that they are capable of withstanding for long periods of time, temperatures of more than 600 degrees Fahrenheit. Even temperatures of 1,000 degrees Fahrenheit can be withstood without any damage to the behaviour of the plastic material for continuous periods of about one hour at a time.

At the same time the plastics which have some elastomeric properties, or rubber-like properties, retain these, it is claimed, when they are exposed to temperatures of as low as 100 degrees Fahrenheit.

[The Aerojet General Corporation, Box 296, Azusa, California, U.S.A.]

"SPINNING-COIN" ENGINE

A NEW air-cooled two-stroke internal-combustion engine has no crankshaft, connecting rods, cam shaft, valves or radiator, and because the engine's mass replaces the flywheel, the latter is also eliminated. The main shaft runs through the centre of the engine which is barrel-shaped and gyrates on its own axis. Because of its compact shape the engine has been nicknamed "spinning coin."

It has 12 cylinders, small holes around the middle of the engine providing outlets for the exhaust, and is claimed to have gas-tight qualities associated with the reciprocating engine.

In its 12-cylinder form the engine, which is only 10½ inches in diameter, has a capacity of 700cc, but it is stated that a unit of this same size could be increased to one litre. A one-litre engine is expected to weigh less than 60lb when in the form of a marketable production unit, and for specialised duties it is estimated that this could be reduced to 45lb.

[William R. Selwood, Chandlers Ford, Southampton, England.]

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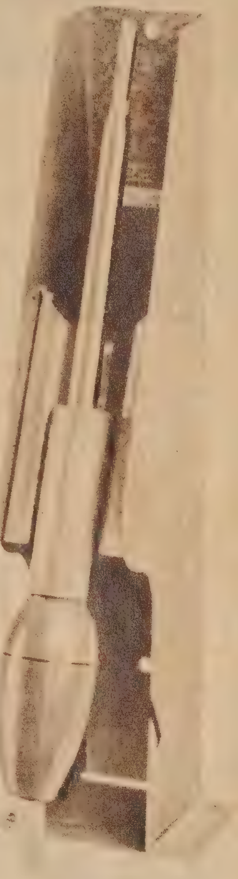

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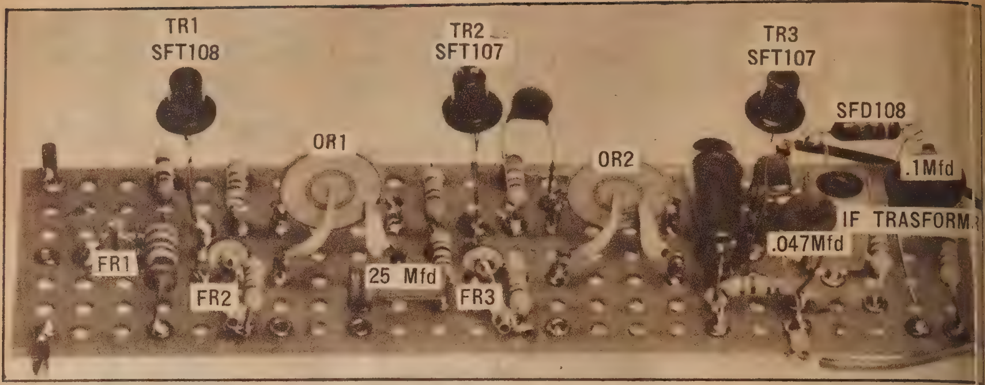


Here is the experimental IF amplifier which we constructed around these new ceramics. The layout is almo identical with the circuit diagram so that the position of the various components including the resonators can b clearly seen.

New principle eliminates I.F. transformers—

RESONANT CERAMIC I.F. AMPLIFIE

A short while ago the Ducon organisation presented us with some experimental resonant ceramic discs and suggested that we might be interested in investigating their possibilities. We constructed an IF strip using the units and were so impressed with the results that we thought we would pass our findings along to readers—not as an immediate project but to indicate the shape of things to come.

By Keith Jeffcoat

WHILE these almost revolutionary units are not commercially available at present, there is every possibility that they will be made available in the near future and it is with the thought of "things to come" that this article is written.

In appearance, the discs closely resemble a standard disc ceramic capacitor. The photograph showing the two types produced to date alongside a standard IF type transistor will give some idea of their size and general appearance.

The first stages of manufacture with the discs is similar to that of an aspirin tablet, in that they are pressed into shape from a powder at high pressures. Extreme accuracy is needed at this stage because, depending on the mode of operation, resonant frequency will be determined either by their thickness or their diameter.

MANUFACTURE

After being pressed to shape and size, the discs are placed in a kiln where they are fired to a temperature of 1250 deg. C for a period of between 2 and 3 hours. When cooled, they are coated on each side with a layer of silver in the form of either an outer "ring" with a centre "dot" for the first overtone variety or a simple "disc" for the fundamental type, which is the smaller of the two illustrated.

The final process is that of polarisation and this is accomplished by placing them in a bath of oil heated to a temperature of around 350 deg. C, while applying a potential of 2,000 volts for a specified time. After ageing for around 30 days, during which their resonant frequency changes very rapidly over the first few days, the discs are ready for use.

In operation, the discs are similar in some respects to the familiar piezoelectric quartz crystal. If they are subjected to a mechanical strain they will produce an electrical charge which, depending on their thickness, could be in the order of many thousands of volts.

In point of fact, if the disc is thick enough, this voltage can be made to fire a spark plug of the type used in petrol engines. This has actually been accomplished in another country.

Conversely, if an electrical signal with a frequency equal to the natural resonant frequency of the element is imposed on them, the element undergoes a maximum dimensional oscillation.

The above illustration shows the fundamental and overtone (ring-dot) resonators in comparison with a normal IF transistor. Their thickness is approximately .030 inch.

The actual resonant frequency of discs is governed by their thickness, area of the electrode plating and th diameter. In the case of the smal of the two discs illustrated the fun mental frequency is 455Kc, at wh point there are no spurious respon and the first overtone frequency is times the fundamental, or approximat 1.18Mc.

OVERTONE RESPONSE

The larger disc has a fundamental sponse, governed by its thickness, 120Kc, a first overtone, governed by diameter, of 3.8 times the fundamen or 455Kc and a second overtone arou 800Kc which is accompanied by a nu ber of spurious responses.

It is a strange but desirable peculi ity of these discs that their overto frequencies bear no harmonic relati ship whatever to their fundamental f quency.

Illustrated at Fig 1 are the equival circuits of each of the two different ty available. As can be seen from t the fundamental type looks like a seri parallel arrangement and, as such, identical with a standard quartz cryst The major difference is in the sepa tion of the resonance and anti-resona points of each, and this is due entirely their different "Q" factors. With t disc the impedance is approximately ohms at resonance while at the a resonance point it has an impedance 6,000 ohms.

In the case of the "ring-dot" or ov tone resonator, the equivalent circ ta s the form of a "four-terminal net- w k," similar to but different from the fa iliar "pi-network" commonly used in th output circuit of most modern trans- m ers. It differs slightly in that a capa- ci r, C1, is in series with the inductance L.

he electrical response is similar to th of a pi-coupler, in that impedance tr sformation is possible between the d and ring electrodes. The maximum o ers of transformation ratio is in the t order of 10 to 1, this being from the d to the ring electrode. Higher im- p ance ratios would be possible by m ing the dot electrode very small but t efficiency of excitation decreases, re- s ing in increased insertion losses.

SIGN CRITERIA

n establishing design criteria for ring a dot resonators an empirical approach h been used. The specifications that a required are the input and output i edances, the centre frequency, and t bandwidth.

t has been found that the input and c put impedances are equal to the cap- tive reactances of the dot and ring. is is true when they are evaluated at t centre frequency of the passband. erefore, knowing the input and out- t impedances required, the capacitance the ring and dot can be specified.

There is, however, a limit to the mini- m and maximum impedances which it possible to obtain.

The capacitance of the ring and dot tions is determined by the area of the ctrodes, the thickness of the resonator d the dielectric constant of the mat- al. The maximum electrode area is ersely proportional to the resonant quency and this places the limit on e minimum impedance that can be signed into a resonator.

The impedance can be increased by aking the electrode smaller with spect to the total area of the disc but e limit in this direction is reached when e electrode is made so small that the sc cannot be excited efficiently. For od excitation, the minimum electrode ea should not be less than one quarter the total area of the resonator.

It is rather a strange coincidence that e optimum size for the ceramic reso- ators at present available results in a ntre frequency of 450Kc for both the ndamental and overtone types.

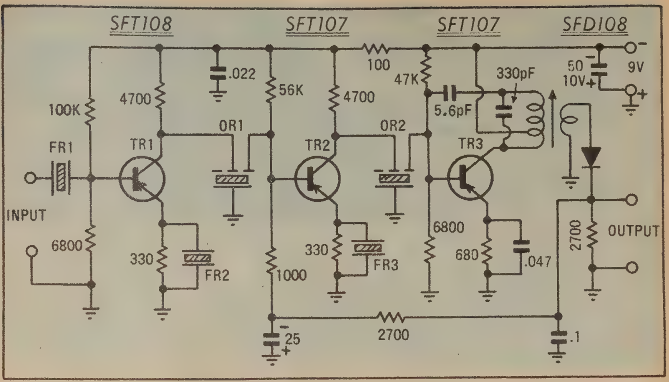
In the case of the units made avail- ble by the Ducon organisation, the in- ut capacitance is 400pF and the output apacitance 1,750pF which gives us an put impedance of 1,000 ohms and an utput impedance of 200 ohms. These w orders of impedance mean that the resent discs are most suited to transistor ircuitry.

CIRCUIT DESIGN

The circuit on this page shows the .F. amplifier complete with second de- ector and A.V.C. which we constructed round these discs.

This is a three-stage unit having fundamental resonator (FR1) series oupled to the base of the first tran- istor, two overtone resonators (OR1 and R2) coupling between stages and two undamental resonators (FR2 and FR3) s emitter bypasses on the first and econd transistors. The third transistor s coupled via a conventional IF trans- ormer with a low impedance output winding into the diode detector.

Without the input coupling filter FR1, he input transistor TR1 could conceivably be the mixer oscillator transistor though, in this case, we have made it a straight amplifier. The first two stages, as can be seen from the circuit, look very much like a conventional RC coupled amplifier, with the discs providing the coupling between stages.



This is the circuit diagram of the amplifier which we constructed. A normal IF transformer is used to feed the diode detector although it would have been possible to replace this with a ceramic resonator and thus completely ceramicise the IF strip.

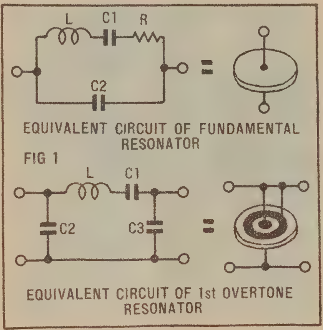

L
C1
R
C2
EQUIVALENT CIRCUIT OF FUNDAMENTAL RESONATOR
FIG 1
L
C1
C2
C3
EQUIVALENT CIRCUIT OF 1st OVERTONE RESONATOR

Fig. 1: Diagrams show the equivalent circuits of both the fundamental and overtone resonators. Electrically they look like a series parallel and a modified Pi (or four terminal) network.

In point of fact this is almost so. If we were to remove the ground connection on each of the discs, their capacitance (the product of their dielectric constant plus their electrode area) would give us a straight RC amplifier.

COUPLING

With the filters in circuit, however, we find that we have resonant coupling between stages and, at the same time, an impedance transformation between the collector of one transistor to the base of the following transistor.

This impedance transformation is not an optimum one but it is not inconsistent with accepted practice of mismatching between stages of tuned amplifiers in order to achieve an adequate stability factor.

The collector of each transistor has to be fed via a resistor which may or may not be a problem, depending on circumstances.

When first constructed the amplifier had only the two overtone resonators (OR1 and OR2) in circuit, the three fundamental resonator positions being occupied by .01 mfd capacitors. The fre-

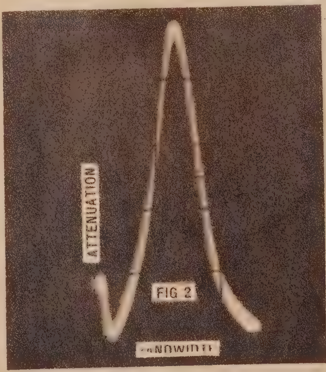


Fig. 2: This is the frequency response of the unit using two overtone resonators. The fundamental resonators were replaced by capacitors.

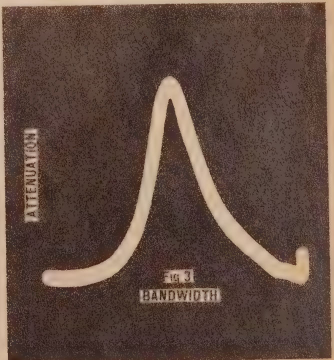


Fig. 3: This shows the frequency response of a single fundamental resonator series coupled to the input of the amplifier. All other resonators are replaced by capacitors.

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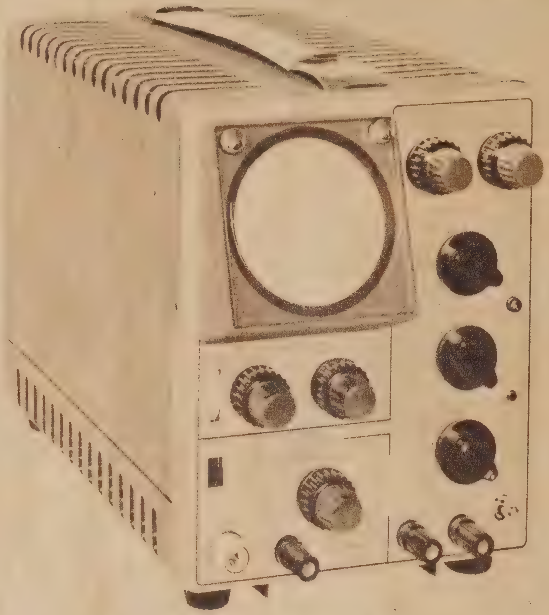

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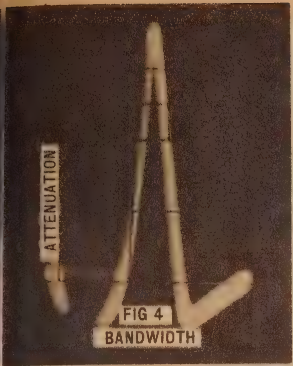

Fig. 4: This shows the effect of using ceramic resonators as emitter bypass's on the first two transistors. OR1 and OR2 were replaced by capacitors.

quency response with this combination is shown by the CRO sweep pattern of figure 2.

oth the resonators were on the same frequency so that response is fairly well peaked, the band width was 4Kc at 6dB down and 5.8Kc at 20dB down. With a standard audio board, such as is used on our "Twin Stereo Player" attached to the output, the sensitivity was 3 microvolts for 50 milliwatts output!

The bandwidth of these overtone resonators is governed by the difference between the resonance and anti-resonance points of the two "dot" electrodes which, in the case of the type manufactured by Ducon, works out at the aforementioned 4Kc.

If desired, neutralisation may be arranged by placing a capacitor between the ring and dot electrode because of the phase reversal which exists between these two electrodes. In our case this was not found necessary, the unit being completely stable.

FUNDAMENTAL RESONATOR

The next step was to install a fundamental resonator at the position shown as FR1 on the main circuit diagram and replace each of the overtone resonators with a coupling capacitor between the collector of one transistor and the base of the following transistor.

In order that the IF transformer should not contribute overmuch to the curve obtained, it was shunted with a resistor to considerably lower its Q.

With FR1 acting as a series coupler to the first transistor and providing a passband at its series resonant frequency and the rest of the amplifier capacity coupled, the curve shown in Fig. 3 was obtained.

This curve was approximately 6Kc wide at 6dB down and had quite a reasonable shape factor as can be seen.

Our next experiment was to test the units as resonant emitter bypass capacitors. To this end FR1 was once again replaced with a .01 capacitor and a fundamental resonator installed in the positions shown as FR2 and FR3.

At their series resonant frequency the discs form a low impedance path for the signal and the gain of the stage is greater than that which would be obtained with a .01 mfd bypass capacitor. The impedance of the discs will be less than 15 ohms at this point.

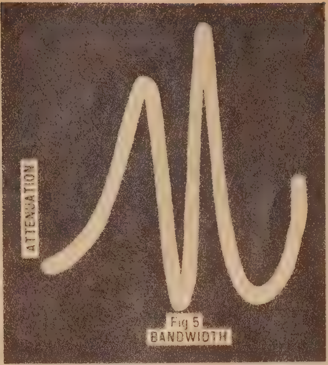

Fig. 5: This response curve was obtained in the same manner as Fig. 4 with the exception that FR2 was separated from FR3 by 2Kc. The Double response can be clearly seen.

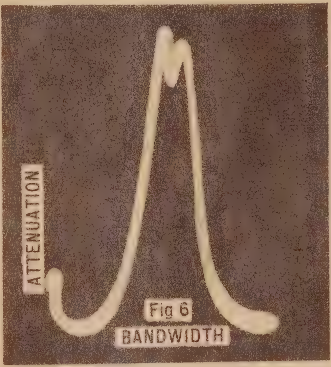

Fig. 6: This curve shows the response of the unit with all resonators in circuit. It very nearly resembles that obtained from a half lattice filter and has good bandwidth and shape factor characteristics.

At frequencies on either side of the resonant frequency negative feedback will be introduced in the emitter circuit by the rising impedance characteristic of the disc and the amplifier will be emitter degenerative at these frequencies. Since the input impedance of a transistor increases with increased degeneration in the emitter circuit the result is a bandpass curve somewhat like that shown in Fig. 4.

DOUBLE RESPONSE

This was obtained with both FR2 and FR3 resonant at the same frequency. Fig. 5 shows the effect of having FR2 resonant at 450 Kc and FR3 resonant at 452 Kc. The pronounced double response produced by the two different resonance points can be clearly seen.

As a final test we replaced FR1, OR1 and OR2, removed the shunt resistor across the IF transformer and once again "swept" the unit to produce the curve shown in Fig. 6.

For this test FR1 was chosen because it was series resonant at the centre frequency of OR1 and OR2 while FR2 and FR3 were series resonant at each side of the passband. The result was the classic double humped, steep sided response curve usually associated with crystal lattice filters.

Some of the advantages of these discs over conventional IF transformers are:

(1) They require no initial alignment nor periodic realignment.

(2) They are virtually indestructible and under normal service should outlast the unit in which they are installed.

(3) Their bandwidth versus insertion loss characteristic is superior to a conventional transformer and

(4) The manufacturing process used in the fabrication of the resonators lends itself to low cost production, providing sufficient quantities can be made.

On the debit side it must be stated that the discs have some frequency shift with change in temperature. This is in the order of a 9.5 Kc shift with a 30 deg. C change in temperature. Work is under way to improve this characteristic and engineers are hopeful of solving the problem.

With this problem solved it will be possible to use the discs for applications such as electro-mechanical filters to be used in SSB receivers and transmitters. The cost of such filters would be considerably lower than present-dav mechanical filters or quartz crystal lattice filters.

At the present moment we are experimenting in our laboratory with a prototype six transistor portable radio which will be almost completely "ceramicised." The only inductances in it will be the aerial loop and oscillator coil. If it works out as hoped, details may be published on the basis of "experimental only" pending full-scale commercial release of the units.

(Editor's Note: It is understood that limited numbers of resonant ceramic discs are to be made available for developmental work. Interested persons should contact Ducon Sales Div., c/- Ducon Industries Ltd., Villawood, N.S.W.)

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Here's your answer, Tom!

As promised in the last issue, the topic for discussion this month is the Valve Tester, possibly one of the best known of all domestic measuring instruments. The article opens with a discussion of valve ailments and progresses with the basic principles of Shorts, Emission and Mutual Transconductance tests.

By JAMIESON ROWE

As we found in an early article of this series, the Thermionic Valve consists basically of a glass or metal shell or envelope enclosing a near-vacuum in which there are various metal electrodes. One of these electrodes, the cathode, is raised to a temperature where electrons at its surface have sufficient thermal energy to travel a short distance away from it in the surrounding space.

Another electrode, called the anode or plate, is connected to a source of EMF so that it is positively charged with respect to the cathode and the electron cloud around it. Thus the electrons are attracted to the plate.

ACTION OF GRID

By interposing a number of fine wire electrodes between the cathode and the plate, and charging them negatively with respect to the cathode, the flow of electrons between the cathode and plate may be controlled. Variation of the negative potential on these control electrodes or "grids" may be arranged to produce considerable variation in the cathode-plate electron current, producing an amplified signal.

What can go wrong with such a device?

Well, one source of trouble is the cathode. As we found earlier, this is heated to its operating temperature by passing a current through either the cathode itself (directly heated) or through a special heater element inside it (indirectly heated). Since it operates at a high temperature, the mechanical strength of the cathode and/or heater is rather low. Sharp knocks or vibrations may easily fracture it and render the heating circuit inoperative with disastrous results.

Naturally enough this fault is called an "open-circuited heater." It is usually easy to determine, since the valve does not glow. Alternatively, almost any simple continuity tester may be used to check it.

To provide a suitable surface for the emission of electrons at reasonable temperature, most modern valves have a cathode coating of metallic oxides. After a considerable period of operation at the temperatures involved, the relevant property (namely, surface work function) of the oxide coating alters.

This causes a slow decrease in the number of electrons emitted by the cathode at normal operating temperature, and generally lowers the valve performance. Roughly speaking, there are "less electrons to work with." This effect is what is normally known by the expression "weak emission" or just "poor" or "sick."

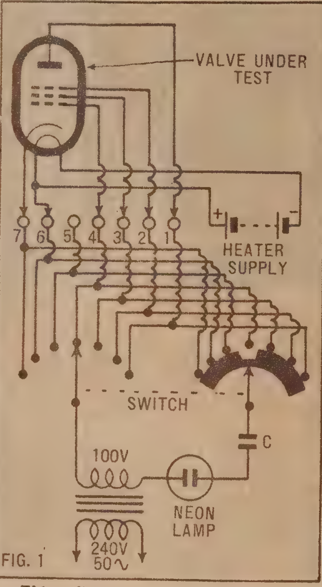

FIG. 1

This diagram shows the basic "shorts" test, used to determine whether any electrodes have shorted within the valve.

Again, molecules of air or other gases may appear in the supposed "vacuum" of a value, either via a small crack or leak, or released from metal electrodes under sustained high temperatures. When this occurs, many of the molecules collide with the fast moving electrons. Besides upsetting the normal operation of the electron stream, this produces positive gas ions. These are attracted to the negative grid, causing grid current to flow or a cloud of ions to collect around the grid, preventing normal control action.

These effects are generally described by the words "gassy" or "soft," the valve being said to contain gas.

Another valve fault which may occ is interelectrode shorting, caused by eith structural mishaps or small foreign pa ticles becoming wedged between ele trodes.

Since the method of testing for inte electrode shorts is possibly the simple of all valve tests, this would seem to a good spot to start the discussio Figure 1 shows one of the most commo yet comprehensive tests of this type.

Firstly, note that the valve has pow supplied to the heater. This is done order that the valve may be tested normal operating temperature, so th shorts or leaks which only appear higher temperatures will show up.

Basically, the test circuit consists of series combination of a capacitor C, neon lamp, and a transformer supplyi about 100 volts AC. By means of switc ing, the circuit is connected between ea electrode of the valve and the remainin electrodes. (In the position shown, f instance, the testing circuit is connect between the control grid and all the r maining electrodes.)

If there is a short circuit between t

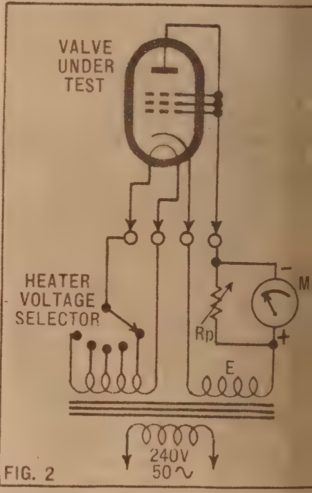

FIG. 2

The basic emission test. Total cathode current for rated heater voltage is indicated by the meter M.

ode selected and any other, current low and the neon lamp will ignite. ou will notice that the second r connection is not made to the ircuit. If it were, the testing switch d short out the heater supply on all he two heater positions, and in these ort would be registered!)

other point to watch is that the al conductive path within the valve, he electron stream, does not register short circuit. We could overcome by testing the valve "cold" (without eating the cathode), but this limits sefulness of the test. Instead, we use of the fact that this is a unitional current which flows only from athode to electrodes which are posi- with respect to it.

PLE SOLUTION

ote particularly the function of citor, "C". As we found in an er article, a capacitor merely acts certain impedance as far as AC is erned. As far as the unidirectional ent passed by the valve is concerned, cts as an open circuit (after it bees charged to the supply voltage, in ry short time).

operation, the testing procedure is ple: first the valve electrodes are nected to the circuit, and the heater nections made to the heater supply. selector switch is then manipulated n electrode to electrode, and the neon p will indicate any short circuit. (In cathode position of the switch, the p will glow momentarily, as the acitor charges up. Within a second, vill extinguish, however, unless there short.)

he Emission test is the next logical to consider. Figure 2 shows the ic circuit for this test. Initially, the ter voltage switch is used to select correct heater voltage for the valve ng tested, as supplied by the transner.

ll the remaining electrodes, apart m the cathode, are then connected ether, and connected via a moving milliammeter "M" to a winding on transformer. During positive halfles of the voltage wave supplied by transformer, emission current will v, and will register on the meter. h a circuit is sometimes referred to "self-rectifying," and has the advane that no rectifier need be provided the circuit.

If the valve has normal emission, the ter will indicate a current value equal the correct total cathode current at voltage "E" (due allowance being de for the pulse waveform). If the lve is poor, a smaller current will be istered.

ALIBRATION

To cope with the wide variety of lve types, we provide the variable nt (Rp) across the meter, and this is ibrated in terms of the valves to be ted. In this way the meter scale may calibrated directly in terms of ood," "Fair," "Bad," and any valve y be accommodated by varying the eter sensitivity so that known good lves register in the "Good" section.

[Note particularly that we are only ncerned as to whether the cathode erates a sufficient number of electrons do the job required. It may liberate re, but this has no bearing on the lve's performance. Thus a valve is erely "Good," "Fair" or "Bad," with additional merit if it happens to read higher than average on the "Good" scale.]

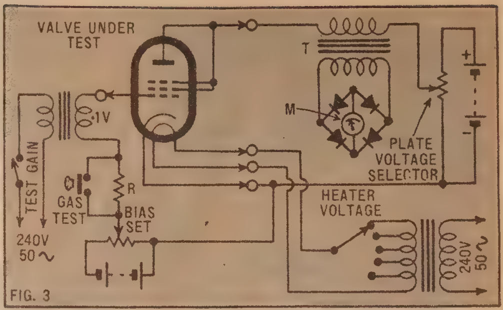

FIG. 3

One circuit for determination of the mutual transconductance of a valve. The alternative component of the plate current is directly proportional to transconductance since a fixed grid signal is used.

This test gives a good indication of the performance of a valve, though not without some limitations. Its main advantages are that it calls for relatively simple equipment, can be performed in a minimum of time, and measures that characteristic (emission), which is bound to fail, eventually, in all valves.

Its disadvantage is that it does not measure the control action of the grid. For this reason it cannot detect a few rare "curly ones" which crop up from time to time, nor can it measure the valve's behaviour in precise terms as might be required for more specialised applications. To test a valve on this basis, i.e., as an amplifier, some form of mutual transconductance test must be performed. Figure 3 shows the basic circuit for one test of this type.

As before, the valve is connected into the circuit and the correct heater voltage selected via the switch and transformer. The grid bias and plate voltage selectors are then set to place the valve under the recommended operating conditions, found from the manufacturer's data.

This done, the "Test Gain" button is pressed. This applies a fixed small alternating voltage to the grid in series with the normal bias. Due to the mutual transconductance of the valve, this will appear in the plate circuit as an alternating component of its plate current. This current, flowing in the primary winding of transformer T will cause a proportional AC voltage to be developed across the secondary winding, which is rectified and registered by the meter M.

(It has probably occurred to some readers that the circuit shown is a rather crude one, in that it will not be accurate with power valves, etc., having low plate impedances. The circuit was chosen,

(Continued on Page 36)

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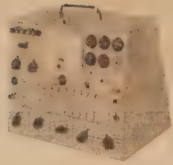

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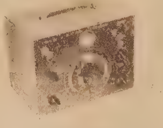

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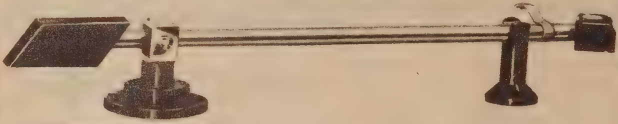

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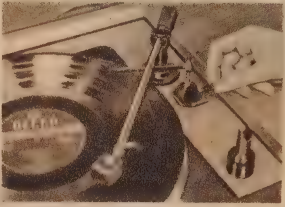

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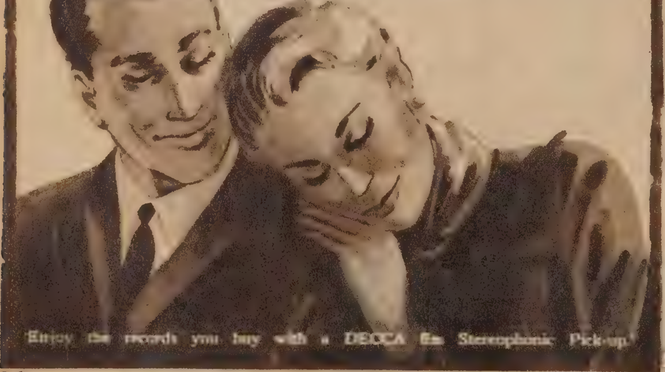
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YOUR ANSWER, TO

(Continued from Page 33)

however, because it shows the basic ciples of the test clearly.)

Fairly obviously, the reading of M be directly proportional to the m transconductance of the valve. (Not this will only be true if the AC gri nal is small compared with the DC bias, so that the operating point o valve is effectively constant.)

In other words, the scale of M easily be calibrated directly in uni transconductance, micromhos or mhos. Thus a meter reading of 1 mho of transconductance would that the 0.1 volt signal on the grid duces an alternating component of current of 0.1 milliamps.

Note that the grid circuit of the under test has a resistor R in series, that there is a shorting button a this resistor labelled "Gas Test." understand the operation of this recall that we mentioned that gas seriously alter normal grid operatio

Specifically, gas ions attracted to negative grid receive electrons fro (becoming neutral gas molecules ag And, since the grid supplies electro the ions, it must draw upon the supply for more electrons — "to this demand." Thus a grid current is to flow.

GASSY VALVE

With a gassy valve in the test ci any grid current which flows will c a voltage to develop across R. voltage will make the effective bias the valve different from the supply v and the valve will appear to be bi incorrectly.

If a valve under test appears to performing poorly the button conne across R is pressed. This will rem R from the circuit and the bias shift to approximately the correct va The shift in bias will be seen by obvious change in the reading of m M.

In other words, the gas test is formed by merely pressing the but if the valve is normal and there is grid current flowing nothing will hap But with a gassy valve the bias alter on pressing the button and a cor ponding change in reading will observed.

Well, Tom, that's the story of Valve Tester in terms of fundament Obviously enough, practical instrum usually have provisions for combi some of the tests we have been disc ing, by means of switching. The m thing to note when using a combinat instrument of this type is that the sh test should be performed first of al to ensure that the valve will not dam the tester by passing high currents!

Another point is that the simple t of electrode selection shown (using rotary switch) has rather serious dr backs in practice. It just can't deal w modern valves having multiple conn tions to an electrode, for example. T while it was used to show the basic p ciples, you will find that modern test have other systems, such as individ lever switches for each valve pin. (R. TV and H design of January, 19 used the lever switch method, as an ample.)

Next month we will continue the ser of articles on measuring instruments w a discussion of transistor operation a testing.

FROM THE SERVICEMAN WHO TELLS

HE CASE OF THE NOISY CONTROL

Have you ever considered how blithely we accept well established combinations of cause and effect, with little or no thought as to the "why" which links the two? Perhaps this is inevitable in the pressure of commercial servicing, but I always feel we are better equipped to tackle a problem if we know something of the "why" as well as the "what." The story I am about to tell is a typical example.

NOISY volume control is not usu- ally regarded as anything special in way of service problems; most of time it is simply a faulty unit, cured the almost equally simple process of lacing it with a good one.

More rarely it may be caused by the ure of an associated component, usu- a capacitor, which causes DC to through the element. When this pens the control will be noisy while r the condition exists, but will usu- return to normal when the trouble cleared.

n view of this I wasn't particularly cerned when a customer — an obvi- audio addict—pushed an expensive ported amplifier and control unit oss the counter and complained of just s fault. I imagined it would amount to thing more than a routine replace- nt. Only when he began to recount history of the fault did I realise at it might be something out of the dinary.

It appeared that it was a trouble of ite long standing. When it had first peared he had imagined that it was companied by some loss of sensitivity d, even more vaguely, by some distor- n. In any case, he had simply passed over to the nearest service organisa- n, stated his complaint, and left it to em.

Apparently they had replaced the con- ol, without being able to find any other ult, and pronounced it cured. But he asn't particularly happy about it. As r as he could see it still suffered from ss of sensitivity, still seemed to have e indefinable distortion and a little ter, developed a noisy control exactly before.

RIED AGAIN

He put up with this for a few weeks, en sought the help of another service ganisation. Again — apparently — the uipment was checked, a new volume ntrol fitted, and the fault pronounced red. And again the customer felt less an happy about it.

While he was beginning to doubt his wn observations in regard to the gain nd distortion problems, there was no uestion about the noise for, as before, is showed up shortly after the new ontrol was fitted.

Thoroughly browned off, the customer egan to suspect that the control had ot, in fact, been changed at all; that had merely been "doctored" in some ay to quieten it long enough to get e job out of the workshop and back nto his lounge-room.

So, although his knowledge of such atters was quite limited, he decided to fit a new control himself. Fortunately he managed to determine the correct type and value, and also fit it correctly, noting with satisfaction that the noise had vanished. He felt more than ever convinced that the cure would be permanent this time.

Alas for his hopes. After only a few days operation the new control was just as noisy as all the rest. So much for his theory about wicked wanglings in the wireless workshop!

But he was not completely convinced. Apparently working on the assumption that he could have been the victim of a one-in-a-thousand chance and purchased a faulty control, he promptly bought another and fitted that.

As you've probably guessed, this didn't last any longer than the previous ones. However, it did finally convince him that there was something more wrong than just the controls, as well as making him less prepared to dismiss the gain and distortion problems as imagination.

He was in this frame of mind when he happened to mention his problem to one of my regular customers. The latter, ever faithful, suggested that he take the amplifier and tale of woe along to yours truly. Which takes us back to the beginning of the story.

FOREWARNED

When I had heard it all I was rather glad that someone else had had first go at the problem. It was obvious that there was a trap of some kind—whether simple or tricky I had no means of knowing—but at least I was forewarned. Some condition, other than the control itself, was responsible for the noise, and there was no point in replacing the control until I had found the true fault.

My first guess was for a leaky coupling capacitor between the control and the plate of the previous stage, allowing DC to flow through the control. This is the best way I know to create noise in the conventional potentiometer.

Fortunately, the owner had supplied me with an instruction booklet issued by the makers, and this included a complete circuit diagram of both the main amplifier and the control unit. It showed that the volume control, although physically in the control unit, was the last component and, electrically, more logically related to the first stage of the main amplifier, an EF86.

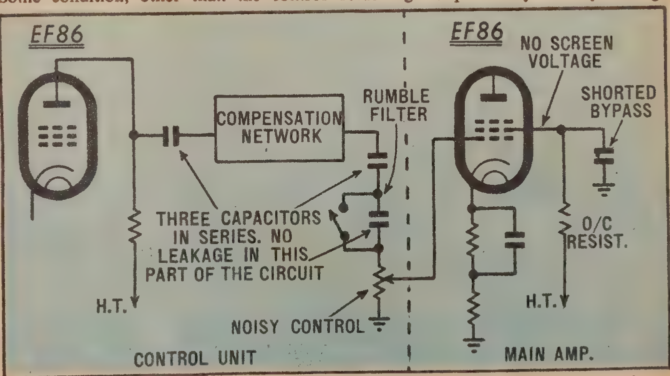
It also showed that, between the last valve of the control unit (another EF86) and the volume control there were at least two coupling capacitors and, when the rumble filter was in the "cut" position, no less than three. Since they were all in series they would all have to be leaky, and this seemed to be stretching coincidence rather too far.

SET BACK

Which was all very discouraging. I had been confident I could put my finger on the trouble in one, only to find the idea squashed before I had even started. All I could do was give it a routine check in the hope that something would show up.

I found the behaviour very much as the owner described it. While I was not familiar with the particular unit it was obvious that the gain was poor for an outfit of this type. There was also little doubt about the distortion and I was rather surprised that the owner—or anyone else for that matter—had been in any doubt about it. Finally, there was the very obviously noisy volume control.

Just to make sure that I hadn't struck three leaky coupling capacitors in the one circuit, I disconnected the lead from the "hot" end of the control, thereby removing all possibility of any leakage



Here are the relevant sections of a control unit and amplifier with the faults which they contained. When the missing screen voltage was restored the noise vanished from the volume control. See if you can work out why, before reading the text.

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Condenser, variable polar pattern, pre-amplifier and power supply with windscreen. 30-15,000 CPS within 3 db. 360 degree pattern. In cardioid pattern 30-15,000 CPS. 35 db front to back ratio.
Model CM65.
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current. It made not a scrap of d ference to the noise level.

At this point I decided on a change tactics. Since the noise problem look like being a curly one, why not tack the more routine problem of gain a distortion? At least I would have tir to think about the one while working the other.

A few seconds probing with a fing on appropriate grid terminals suggest that the lack of gain was in the ma amplifier, so I concentrated on this se tion first.

It didn't take me long. Almost i stinctively I commenced measuring pla and, more particularly, screen voltage And I wasn't really surprised when t screen of the first valve (the EF86) me sured zero.

More precise measurements showe that the screen by-pass had broken dow measuring only a few ohms. This ha not only robbed the screen of voltag it had also overloaded the dropping r sistor to the point where it had passe out also.

Well that was something to go o with anyway.

I quickly replaced the two faulty com ponents, then switched on and touche my finger on the grid circuit again. healthy blurp from the speaker con firmed that the gain was up by many d and a good deal more like what on would expect from such an amplifier.

NO LONGER NOISY

Next I plugged in the control uni with the idea of making some more pre cise checks, using both music and, i necessary, the audio generator and CRO I had almost forgotten about the nois control. It was something of a shock therefore, when I realised, after havin rotated the thing a couple of times, tha it was no longer noisy.

Why?

I'm afraid I hadn't a clue at that stage I felt rather like a detective who, havin been presented with a full confessio from the least likely suspect, is face with the task of finding evidence to support what he knows to be a fact.

Somehow or other, unless I was th victim of a most rare coincidence, restoring a screen supply had cured a nois pot in the grid circuit of the same stage And, for the moment, I just didn't hav a theory to fit the fact.

As I said earlier, about the best wa to make a volume control noisy, apar from wearing it out, is to allow DC to flow through it. That this was a possibility in this case was supported b the fact that the trouble had vanishe so completely with a change of circui conditions.

Since I had already proved that i was nothing to do with the previou stage, and established fairly conclusivel that it was related to the following stage, the only possible path for such DC would be through the lower half of the pot and the moving arm, i.e., in the grid-cathode circuit of the following valve.

But why should DC flow in this grid-cathode circuit? Quite suddenly I realised that there was a very good reason for such a condition. With the valve deprived of screen voltage there would be very little plate current; with low plate current there would be very little cathode bias generated, and with virtually no bias the grid-cathode combination would revert to a simple diode, complete with ct potential and resultant current through any available external cir-

of which is delightfully simple one has finally worked it out, but fraid basic theory didn't help very as far as this particular service job concerned. It would have been very had I been able to deduce that there no plate current because there was current. Instead, it turned out the way round.

well, at least I found the fault!

ZLING ASPECT

hich brings me to one of the most ling aspects of the story. How was at the amplifier was handled and— osedly — checked by two other nisations without the faulty screen it becoming apparent? At the risk eeming to be uncharitable, I can surmise that the checks weren't very ough.

inally, while we normally take it for ted that DC through a pot will cause become noisy, have you ever asked self why this should be so?

o?

ell, frankly, I hadn't either, but this y started me thinking.

seemed a fair question, one that ably would interest other service-, and for which it shouldn't be hard find the answer. I imagined all I ld have to do would be to contact ouple of engineers associated with section of the industry and have whole story served up on a plate.

s it turned out, it wasn't quite as y as that. The first engineer I con-ed listened politely while I told the y and put my question, "Why DOES cause noise in pots?"

here was a pause at the other end.

You know, I've never thought much ut that. It's a good question, but I t answer it off the cuff: Can you ve it with me for a few hours?"

his seemed fair enough and I read- agreed. I reasoned I could try a ple of other "boffins" in the mean-e and probably have the whole story nplete when the first chap rang back.

trangely enough, the second call nt very much like the first one. Yes, was a good question, but it would take ittle time to sort out an answer. Could y ring me back?

OMPLEX SUBJECT

And so it went for several more calls. gathered that noise in pots was a very mplex subject — whether related to or not — and that, apparently, ere was still a good deal to be learn-. Some tentative suggestions were made to why DC aggravated the situation, t everyone wanted more time to think out it before committing themselves.

Well, at least those of us who hadn't ought much about it were in good mpany.

Not that I am criticising the engineers ncerned. On the contrary, it is a wise an who knows he doesn't know — and prepared to say so. And it is signi-ant that all those concerned honoured eir promise to ring me back. What more, they had obviously taken a od deal of trouble to find a logical swer.

While a few of the suggestions were, my mind, somewhat doubtful, the ma-rity were quite reasonable. In par-cular, many of the ideas tallied closely, and I was able to build up a clear mental picture of the principles involved. I will do my best to pass it on to readers.

First, there are two likely conditions of DC. One, and probably the most common, is where a preceding coupling capacitor has broken down, allowing current to flow through the entire element. The other is where a fault similar to the one already described allows current to flow through part of the element and the moving arm or wiper.

Secondly, it must be accepted that the element used, by the very nature of its construction, cannot be regarded as continuous surface. As one engineer put it, it cannot be compared to the continuous surface of a metal. Purely to illustrate the point, he suggested that it might be possible to make a resistance element from finely beaten gold, in which case the problem we are considering probably would cease to exist.

As it is, the element is composed of resistance material, basically carbon, in small but finite particles, held together with a suitable binder. The wiper, in its travel, sees the element as a succession of fixed resistors consisting of either the particles themselves or, again quoting this engineer, "—a series of 'conglomerates' or groups of particles."

Thus, as the wiper moves along the element, the resistance in circuit does not vary in a perfectly smooth manner, but rather in a series of jumps or steps. Quite small steps, admittedly, but very definite steps none the less.

If we apply our signal voltage across the entire element and pick off a portion of it with the moving arm, then this voltage must also increase in a series of steps. The only reason it doesn't worry us is because the changes are small relative to the total voltage.

SUPERIMPOSE DC

But now let us suppose we superimpose a DC voltage on the signal voltage. Each "step" now generates a pulse as the wiper moves across it and if, as is often the case, the DC voltage is many times greater than the AC or signal voltage, these pulses will be quite large.

For example, a broken down coupling capacitor may allow 20 volts or more to be applied across an element which is handling only .25 volt of signal; a voltage difference of 80 to 1. This assumes that the control is in its normal place in the circuit where levels of this order are encountered. If we attempt to place the control closer to the front of a high gain amplifier, where levels may be down by a factor of a hundred or more, the situation may well be much worse.

In fact, anyone with even moderate design experience would be aware that a control in such a position is wide open to noise problems, and it may be interesting to speculate just how much of such noise could be due to minute unsuspected leakages in coupling capacitors or equally unsuspected and minute grid currents in following stages.

In simple terms, therefore, this form of noise in a pot is a function of the discontinuities or "steps" inherent in the element. It is normally so far below the signal level as to be insignificant unless aggravated by such things as spurious DC.

In fact, the application of DC to the element is used by some manufacturers as a means of checking noise on production runs. With a moderate voltage, say 20, applied to the element, the wiper is caused to travel over the element at a precise speed. The output is applied to a calibrated wide range audio amplifier and the level of noise measured in millivolts. This is compared with standards already established, and faulty units or batches rejected.

The point is that this test is nothing more nor less than a measurement of the size of the steps in the element. If they are too big, the noise is high, and the unit unsatisfactory.

The second case, i.e., where DC flows through part of the element and the moving arm, does not differ greatly in principle. There are still steps in the element and the current can only increase in a similar manner. Assuming that this current eventually becomes a signal voltage as far as the following valve is concerned, we find that noise is generated in much the same manner.

However, there appears to be another effect in this case. Minute arcing is thought to occur between the wiper and the element particles, creating further random variations in current flow.

GRID CURRENT

While discussing this aspect with one engineer he was able to confirm that grid current in valves can create serious noise problems. His experience apparently concerned a particular commercial receiver which, by reason of its design, was prone to grid current in the first audio stage. It directed a lot of blame on to the controls until the design was shown to be at fault.

Finally, there is the question of why a new control may behave normally for a short while, even in a faulty circuit. As far as I can make out brand new controls usually have a substantially higher order of performance than average, even though it is short lived. Once this "newness" wears off, the effect of a faulty circuit becomes apparent.

In conclusion, I must emphasise that all the foregoing concerns the problem of spurious DC. It is not the only type of noise. We all know that pots become noisy anyway, given time, or even when new if the conditions are too exacting. But that is another story, and I have deliberately tried to avoid clouding the issue. As I said at the beginning, it appears that there is still a lot to be learnt about noise in pots.

But at least we should now have a better idea of why spurious DC causes so much bother.

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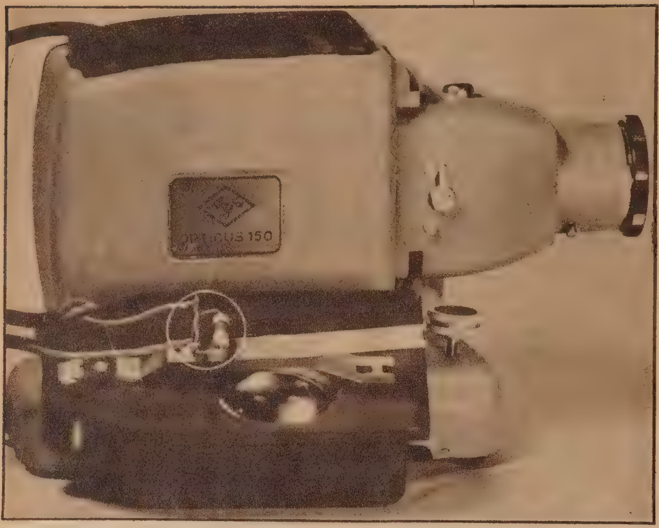


This picture shows how easily a small thermistor (circled) may be mounted in a 150 watt projector. The lamp and reflector assembly are removed as one unit.

Protect Your Projector Lamp

If you are an amateur photographer, worried about the cost and embarrassment of burnt out projector lamps, then this article is for you. It discusses the cause of premature failures and the practical application of a simple protective device. It could well save you many pounds in lamp replacements.

By Philip Watson

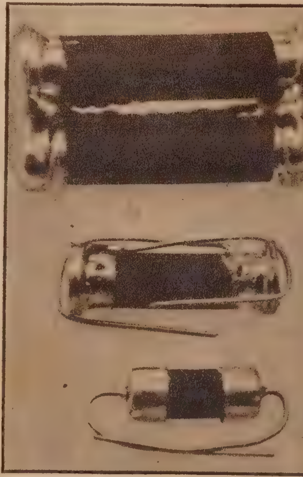
A BURNT-OUT projector lamp is an irritating situation, to say the very least. At best—assuming one is wise enough to stock a spare—it means an annoying delay while the new lamp is fitted. At the worst—and it is surprising the number of people who carry no spare—it can mean an evening spoiled and embarrassment in the presence of disappointed guests.

COST REAL MONEY

And either way, there is the hard fact to be faced that projector lamps cost money; a good deal of money in some cases, ranging from a pound or so in the case of low wattage types, up to three pounds for the 500 and 1000 watt types. While the latter are more frequently found in semi-professional installations, such as clubs, churches, etc., such organisations are normally just as conscious of the cost and inconvenience as are individuals in their own lounge-room.

But can anything be done about it? All such devices must fail eventually and most of us accept this philosophically enough. What does hurt is the brand new lamp, costing several pounds, which fails the third, second, or—yes—even the first time it is switched on.

Fortunately, in regard to these premature failures, something can be done. What is more, it probably will add many hours to the average life of all lamps.



Thermistors for lamp protection. At bottom the CZ9A, next the CZ11, and two CZ12s (500 watts each) in parallel for 1000 watt

The great majority of failures occur at the moment of switching on, and th is a very good, easily understood, rea for this. The material from which lamp filaments are made has quite high positive temperature coefficient in simple language, the resistance is v much higher at working temperat than when cold.

The order of charge may vary, bu always quite high. In the case o typical 1000 watt lamp the cold res ance was measured as 4 ohms, as agai the hot resistance which may be calc ated as nearly 60 ohms; a difference 15 to 1. A typical 150 watt lamp 28 ohms cold as against 385 ohms hot difference of much the same order, i nearly 14 to 1.

LOW RESISTANCE

Where a lamp is connected directly the mains it must be assumed that resistance of the supply is so low as be negligible, meaning that the o limitation to the rate of flow is the sistance of the lamp itself. In ot words, at the moment of switching there will be a current surge appro mately 15 times greater than the runn current.

Small wonder, then, that many la failures occur at this critical moment, distinct from those while running. also becomes obvious that anything can do to limit this surge will cure great majority of premature lamp f ures, allowing the lamp to wear rather than blow out.

It might be wondered why projec lamps are more prone to this trou than conventional lamps. There app to be two reasons for this. One is fact that a projector lamp, by ordin standards, is an "overloaded" device, being the only way to achieve sa factory brightness and colour tempe ture. It is deliberately designed for short life and a merry one."

The second reason is rather more teresting. To provide a concentra light source the filaments are norma arranged in parallel coils, an arran ment which can only lead to a reacti of magnetic fields. Thus, during switch on surge each filament is s jected to considerable repulsive or attr tive stress. Due to its brittle nature may easily fracture, whereupon pieces filament fly in all directions.

LIMITING THE SURGE

There are several ways of limiting surge. One is to introduce some re tance into the circuit until the lamp reached a reasonable temperature, th short it out to bring the lamp to f brilliance.

Such an arrangement works quite w and a resistance unit for this purp was described in the March, 1961, iss However, there is the disadvantage t this device used disposals parts wh may not be available to everyone, wh in any case, it involves a certain amo of mechanical construction. In additi there is always the risk it may not moved back from the "run" position the "start" position after use, leaving lamp unprotected at the next start.

A more automatic arrangement is to use a 110-volt lamp from 240 volts with a suitable dropping resistor. The dropping resistor also functions as a surge limiting resistor, and is always in circuit. Some commercial sub-standard movie projectors employ this idea.

This idea also works well but, again, there are objections. The main one is that such a resistor must be quite bulky and must radiate a lot of heat, making a rather awkward device in many circumstances—and wasteful.

The third solution, and the one we wish to discuss at some length, is the use of thermistors. Thermistors are a special form of temperature sensitive resistors, having a high negative temperature coefficient (their resistance decreases with an increase in temperature). Since this is the exact opposite of the lamp characteristic it is ideal for our purpose.

SERIES CONNECTION

All that is necessary is to connect one of these devices in series with the lamp so that, at the moment of switching on, its high (cold) resistance effectively limits the current through the low (cold) resistance of the lamp. As both the lamp and the thermistor commence to heat, the resistance of the one rises and the other falls, allowing more and more voltage to be applied to the lamp and less and less to the thermistor.

Eventually a state of equilibrium is reached where the thermistor offers a minimum resistance, though still sufficient to maintain it at a high temperature (high wattage dissipation for its physical size) at the normal current flow of the lamp. Under these conditions most of the voltage is applied to the lamp and only a very small amount to the thermistor.

The beauty of this scheme is that it is completely automatic. The user does not have to operate any switches or other devices and, in fact, need not even know that the thermistor is in circuit. Thus there is no chance that, as with a manually operated device, it can be inadvertently left in a wrong setting.

Another worthwhile advantage is that it is quite compact, being only about the size of a conventional three or five watt resistor, and does not require special ventilation. On the contrary, the hotter it runs the better. This means that it can normally be accommodated within the projector lamp house with a minimum of inconvenience.

A special outlet, with a thermistor in the base, may be used where it is inconvenient to modify the projector.

A close-up of the bonded pair of CZ12s, showing the thermal bond made from plumber's 50/50 solder.

There appears to be only one circumstance in which the thermistor will fail to give full protection. This is where the lamp is switched off briefly, then switched on again. Depedning on type, the thermistor requires from six to 12 minutes to cool adequately and, if the lamp is switched on again in less than this period, only partial protection will be provided. However, this will still be a lot better, in most cases, than having no protection at all.

SHORTING SWITCH

(If this limitation should prove a serious problem, it is possible to incorporate a switch to short out the thermistor once the lamp is running. This allows the thermistor to cool, in preparation for the next switching cycle. However, this introduces a manual function which can be overlooked, thus leaving the lamp completely unprotected once more.)

A point which may bother some photo-enthusiasts is the possibility that any resistance introduced into the lamp circuit will prejudice brightness and colour temperature; something which cannot be tolerated when one's photographic reputation is at stake.

Happily, they need not worry. While a typical thermistor (as used for a 150 watt lamp) will have a cold resistance of around 350 ohms, this will drop to 3.7 ohms under maximum current conditions. In more practical terms (with a 150 watt lamp) it will produce a loss of only 4.5 volts, or about 1.8 per cent. This is a good deal less than normal line voltage variations in most localities.

Finally, there is the all-important question of price. Once again the position is a happy one, because this ranges from a mere 2/11 for the smaller ones to 6/8 for the largest.

Cheap insurance indeed, where several pounds worth of projector lamp is involved.

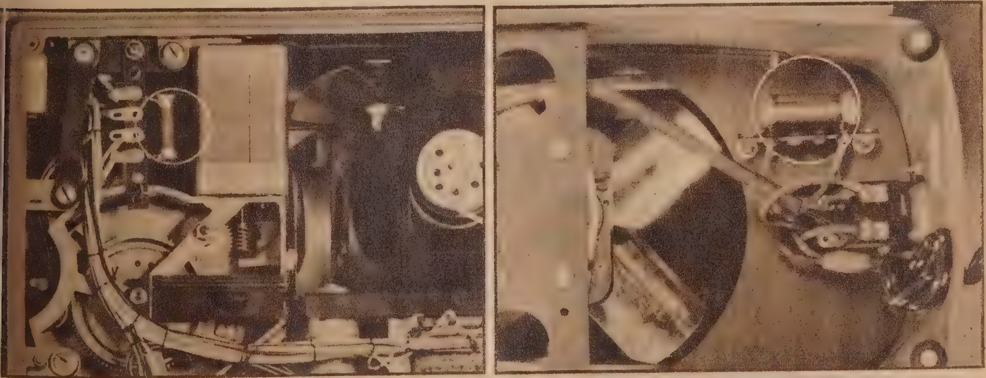
Having thus made a case for these units, let us have a look at them, and their method of use, in greater detail. The range on which the following experiments were based are the "CZ" series marketed under the name "Brimistor" and distributed by Standard Telephones and Cables Pty. Ltd.

TYPICAL PROJECTORS

In order to learn at first hand just what problems, if any, had to be solved we selected a number of projectors belonging to staff members and fitted each with the appropriate unit. The lamps involved ranged from 150 watts to 1000 watts, the latter being of particular interest, since it involves parallel operation of thermistors.

There are three thermistors available for projector lamp protection, the CZ9A for 150 watt lamps, the CZ11 for 250 and 300 watt types, and the CZ12 for

Continued on page 108.



At left is the Pradovit 300 watt projector, with a CZ11 thermistor (circled) supported on a modified tag strip. At right is shown a parallel pair of CZ12s as fitted to the 1000 watt Aldis model. Note that in both cases the thermistor is well clear of other components and the cooling draught from the fan.

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34. 35 Watt P.A. Amp.
35. Standard 10 Watt Guitar Amp.
36. Standard 20 Watt Guitar Amp
37. Transistor 1
38. Transistor 2
39. Transistor 3
40 Transistor 4
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43. Transporta (RF) 7
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SPECIAL ANNOUNCEMENT

Watch for September issue of Radio, TV & Hobbies. Our "Globespan 8" kit which has proved so popular and on which we had to temporarily freeze orders to catch up the back lag, will be advertised as o availability, etc.

ELECTRONIC DEVELOPMENTS

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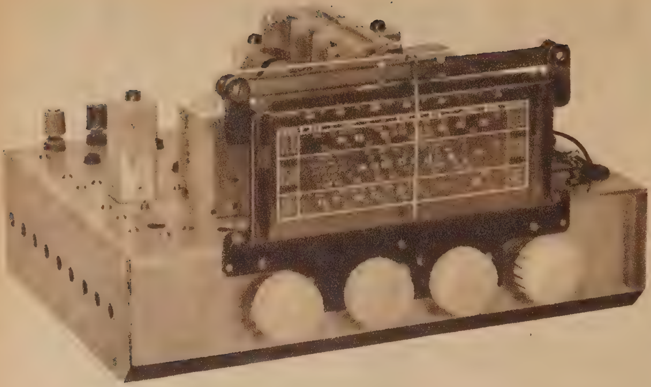


This photograph shows the prototype chassis. Note the adjustment holes for the trimmers along the side of the chassis. The dial glass shown does not have short-wave calibrations, but suitable scales should be available shortly.

Three Band-Eight Transistor Radio

Here is a fully-transistorised three-band receiver designed for both broadcast and short-wave listening. Featuring an RF stage for added gain and selectivity, the set also incorporates a one-watt audio output stage. It operates efficiently and economically from a single nine-volt "dry" battery, making it an ideal set for the country listener.

By Jamieson Rowe

BASICALLY, this set is a logical development from the "Transistor 8" (July, 1960), which was designed for broadcast band operation only. The basic design has undergone a number of alterations in the course of development, however, with the result that the two sets now have little in common.

In passing, it might be worthwhile to remark upon this divergence from our original design. At the time when the earlier set was published, we had in mind to modify it in a following issue by adding a set of shortwave coils. When we set about doing this, however, a number of difficulties became apparent.

CHASSIS UNSUITABLE

In the first place, it became apparent that the original, rather compact chassis and layout would not lend itself readily to multi-band arrangements. The requirements of stability and "reproduceability" (ability to be duplicated by readers) demand that a multi-band design have a logical layout, designed with the various requirements of coupling, lead length, etc., in mind. Adaptation of an existing single-band design just will not do.

Secondly, from our initial tests it appeared that a number of changes would be required to the circuitry, if operation on higher frequency bands was to be satisfactory. Local oscillator, mixer and RF stage circuits in particular required modification.

In the field of audio power output, things had also changed since the description of the Transistor Eight. By using different output transistors and altering components, a power output of one watt (double the old output power) is now easily obtainable. Since the new output stage provides greater power handling capability with little increase in cost or normal battery drain, we felt that the new set could well incorporate it.

In view of these differences between the present design and the earlier set, perhaps the best plan would be to treat the set shown on these pages as an entirely new project. Accordingly, we will begin with a discussion of the circuit.

The first thing of interest is the RF amplifier stage, utilising a 2N370 transistor. To cater for the various bands, the input and output circuits of the transistor are switched to three sets of coils.

You will notice that the RF stage is not neutralised on any of the three bands. This is because experience has shown that, for the type of circuit used (the frequency of operation and the tu range covered), the small advantage unilateralised operation are far outwe ed by the trouble involved. Ad ment proves very critical and the st ity is far from acceptable, anyway.

Thus, since we are describing a ject intended for the home constru we decided that it could well be omi

The procedure of "designed mism for stability" has been adopted, to en good stability yet practical operat (For interested readers, a very infor tive paper on this subject has been cently published by Mr D. M. Dun B.Sc., entitled "Narrow-Band Stabi Limited I.F. Amplifier Design." paper was kindly made available to author by Mr Duncan, through the c tesy of Kriesler Australasia Pty. and the Institution of Radio Engin Aust.)

MIXER STAGE

From the particular RF coil in op tion, the signals pass to the base of mixer transistor, a 2N372. Here, interact with an injected signal from local oscillator circuit, which uses 2N371 transistor in a common-base cuit. The injection signal is fed to emitter of the mixer from a second winding on the oscillator coil in quest

A three-gang tuning capacitor tunes aerial, RF and oscillator circuits sin taneously. To enable each band to aligned separately, all the coils have i dust slugs and all are fitted with a tr mer capacitor. Note also that the os lator padder capacitor is changed each band and that the emitter feedb capacitor is also changed.

In the mixer, the injection and recei signals heterodyne forming, among o things, the IF or intermediate freque signal. This is developed across primary of the first intermediate quency transformer IFT1. Via magn coupling, the secondary of this trans mer develops a similar signal, w passes to the 2N308 IF amplifier sistor.

IF SIGNALS

From the collector of this transi the amplified IF signal appears at second IF transformer IFT2. Note the IF transistor is tapped into windings of both IFT1 and IFT2, in interests of selectivity and stage st ity.

Coupled to the collector circuit of IF stage is an OA80 germanium di This diode develops a positive vol proportional to the carrier si strength present at the IF colle Since the base bias circuit of the transistor eventually returns to diode, the developed voltage controls operating point of the RF transi Thus the diode serves as an autom gain control (AGC) generator.

Further to improve the gain-con ling characteristic, use is made of DC emitter-follower action of the transistor, wherein the emitter vol is directly proportional to base curr By returning the base circuits of mixer and IF transistors to this emi ney too, are controlled in operating oin and gain. The final result of this roc lure is to make the set virtually noi overloadable."

F m the secondary winding of the ecc l IF transformer, the signal is de-ecte by another OA80 germanium iod The detected signal passes to the volu e control and a treble-cut type one control, and then to the audio sec-on

T audio amplifier consists of an mp fier stage using a 2N408, a driver g also using a 2N408, and a class-c put stage using two 2N217S transtc s. It it identical to that used in e Transistor Stereo Player" of Decem-r 1960.

DIO BOARD

I actual fact, as shown by the photo-a s, we used one of the printed ir g boards for the complete audio ct n of the set. We did this for two a ns, one that it was already avail-wired (!), and the other that the i ed wiring type of construction lends se to easy duplication and reliable re-ili

aders, who find themselves in a s on where this type of construction oe not commend itself, should find ifficulty in using conventional be-chassis wiring techniques. As the ographs show, there is ample room r conventional wiring and layout if is contemplated.

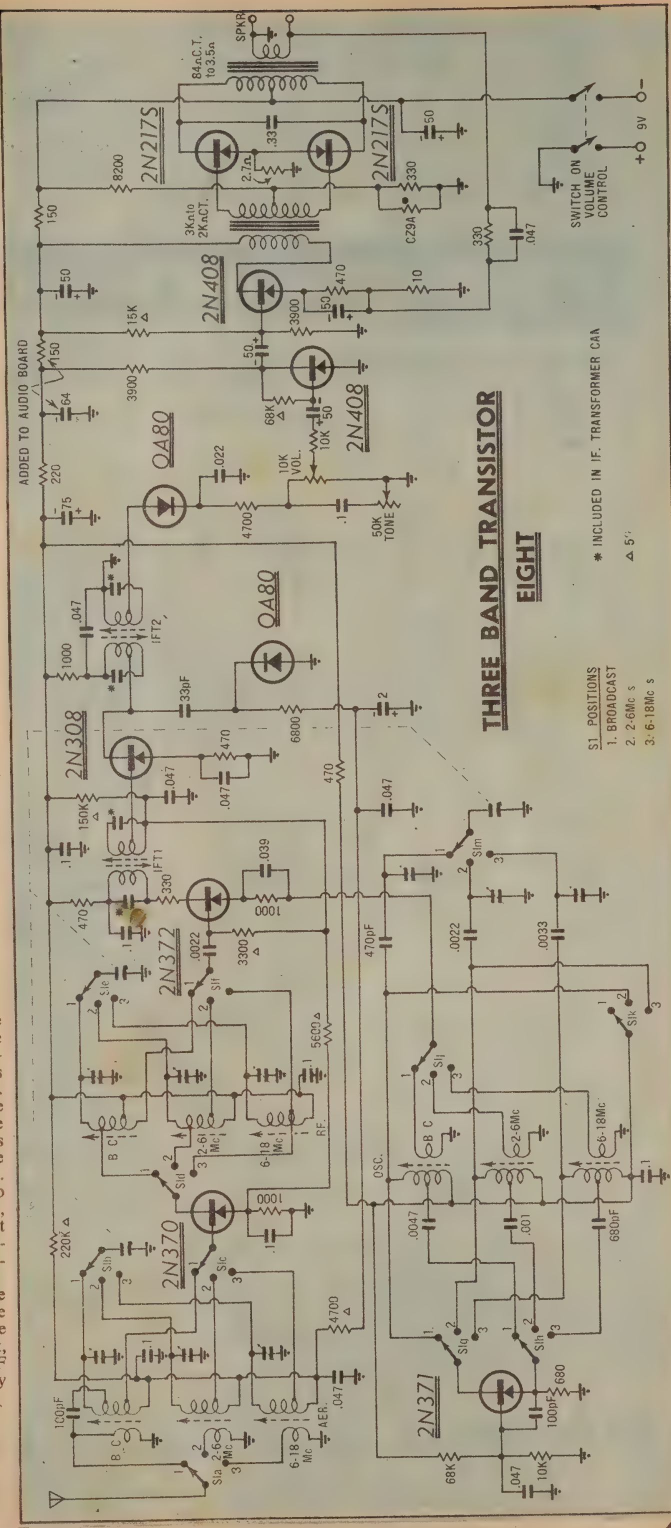
ote that the negative supply line of e ront end of the set has quite heavy ecupling. This is because supply vari-ti s caused by the class-B output stage a upset oscillator operation in the pre-e of strong signals, if adequate fil-er g is not used. Supply voltage varia-io effectively alter the oscillator-ra istor collector capacitance which, at ig frequencies produces frequency culation of the local oscillator suffi-ie to cause motorboating and other m sirable effects.

ote also the use of a switch section o hort out the next-lowest unused os-il tor coil (S1-k). This is done to pre-e inter-coil magnetic coupling from a ing "holes" or dips in oscillator acti-il

M CHANICAL SIDE

ow for the mechanical side of the e gn. The prototype seen in the ot tographs was constructed on a cad-m m-plated and passivated steel chassis m suring 10½in by 8in and 2½in deep. W selected this material as it may be sclered to readily, ensuring reliable ea h returns. Other materials such as b ss, would do equally well, but we w ld warn against using aluminium. D to the difficulty of soldering to t , one has to resort to solder lugs, et, which may introduce troubles at h h frequencies and at the low im-p ances encountered in transistor cir-c s.

ooking at the top of the chassis, we s the audio board at the far left. The t ing gang is in the centre of the c ssis, with the aerial section at front, t n the oscillator, and finally the RF s tion. The broadcast aerial coil may


THREE BAND TRANSISTOR EIGHT
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2N371
2N372
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2N408
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2N217S
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OA80
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CZ9A
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9V
10K VOL.
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S1 POSITIONS
1. BROADCAST
2. 2-6Mc s
3. 6-18Mc s
BC
2-6Mc
6-18Mc
AER.
RF.
OSC.
S1a
S1b
S1c
S1d
S1e
S1f
S1g
S1h
S1j
S1k
S1m

Here is the complete circuit. Note the use of an RF stage for better image rejection and signal-to-noise ratio. A one-watt audio output stage will handle all normal domestic applications.

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7304	Oscillator Coil lug mount	9	10
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● ELECTRONIC STETHOSCOPE July issue, 1961.

4305	Audio Output Transformer	21
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● ALL TRANSISTOR CAR RADIO July issue, 1961.

7103	Aerial Coil	16
7200	R.F. Coil	16
7300	Oscillator Coil	16
9100	I.F. Transformer	17
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● SWEEP GENERATOR 455 KC May issue, 1961.

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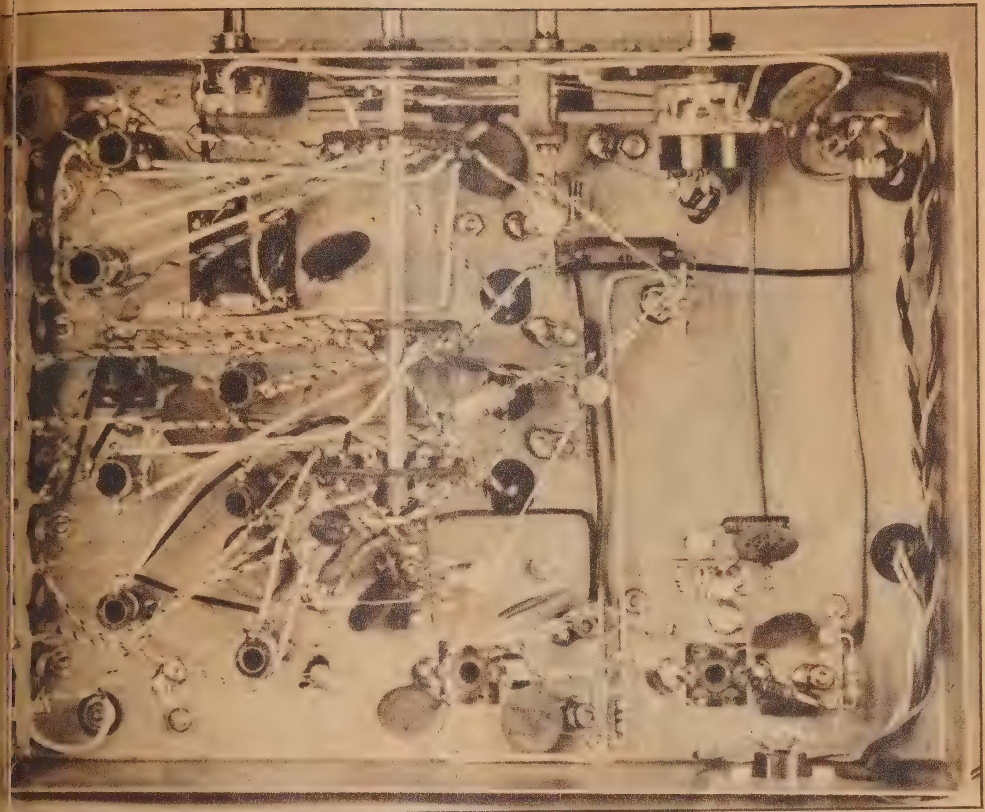

he underside view shown here gives a good idea of the layout. The audio board is above the chassis, on the ight hand side of the picture. Note the use of the "point-to-point" wiring technique to keep lead length to a minimum on all signal wiring.

seen in its large can near the front it of the chassis, with its associate coil nearby. The two coil cans g the rear of the chassis are the IF sformers, with IFT2 directly behind audio board.

erial and earth connections are le via the two spring-type terminals he rear right of the chassis. The ker connection is via the small four- socket on the rear, with the battery s emerging from a grommetted hole gside.

nderneath the chassis may be seen bulk of the small components and wiring. The controls visible are e, bandswitch, tuning and volume—ving from left to right. The nine trimmers are mounted along the -hand side of the chassis, with their lated lugs supported by a length of strip. Adjustment holes of 5/16in meter (spacing ¾in) in the chassis w the trimmers to be set easily once set is completed.

VITCH DETAILS

he bandswitch has three wafers, each arated from the others. The front tion is a three-pole, three-position er and switches the aerial, aerial gang RF transistor base connections.

wo inches behind this is another ee-pole, three-position wafer, used to tch the RF collector, RF gang and er base connections.

Finally, and 1¼in behind the previous wafer, is the six-pole, three-position (double-sided wafer) section used to switch the oscillator emitter, collector and gang connections (on the rear of the wafer, looking from the front of the chassis) and the injection and shorting connections (other side).

Directly behind the tuning knob spindle is the RF transistor, with the mixer transistor behind it again. Both are mounted by their leads on small-type tagstrips (a five-lug type for the RF transistor and a six-lug type for the mixer).

Connections on each tagstrip, working from the front, are as follows: RF transistor, first emitter, then base, shield and collector; the last lug is used to terminate the supply line. On the mixer strip, the first lug is the shield (earth), then the emitter, the base and an unused lug and finally the collector and the other earth (support) lug.

A small three-lug tagstrip at the rear of the volume control is used to support the AGC connections for the mixer and IF transistors and to support the earthy end of the 75 mfd supply bypass electrolytic.

Directly behind the bandswitch is the oscillator transistor, mounted on another small five-lug tagstrip. Connections to this, again working from the front, are: Supply line, collector, shield, base and emitter.

The various coils visible on the left-hand side of the chassis are roughly in two (vertical) rows. Moving rearward down the left row, we see the 6-18 Mc/s aerial coil, the 2-6 Mc/s aerial coil, the broadcast band RF coil (above chassis), the 2-6 Mc/s RF coil and the 2-6 Mc/s oscillator coil.

MORE COILS

Similarly, the other row contains the broadcast band aerial coil (again above chassis), the 6-18 Mc/s RF coil, the broadcast band oscillator coil, and the 6-18 Mc/s oscillator coil. A point which may not be obvious is the use of a small three-lug tagstrip immediately to the front of the square cutout of the broadcast band aerial coil. This serves to support the end of the 4,700 ohm lower bias resistor of the RF transistor.

Note that there are two bypass capacitors connected to the bias point for the RF transistor. One is at the junction of the two resistors at the bias lug of the broadcast aerial coil, the other is from the bias lug of the 6-18 Mc/s aerial coil (to earth in both cases). This ensures that lead inductance does not cause degenerative effects or poor tracking.

From the collector lug of the mixer tagstrip runs a 330 ohm resistor to the collector connection of IFT1, which is at the rear centre. To the right of IFT1

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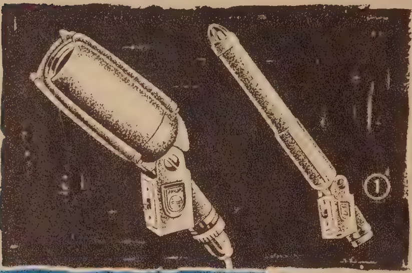

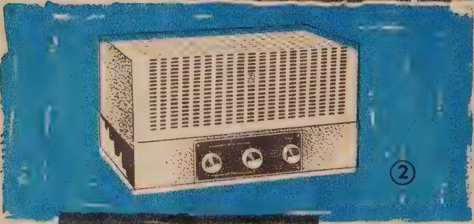

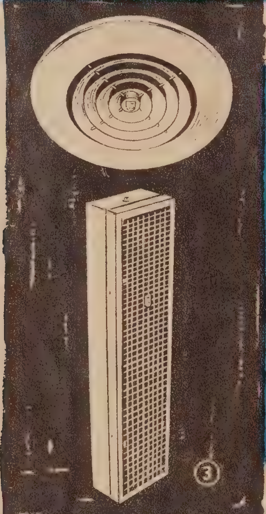

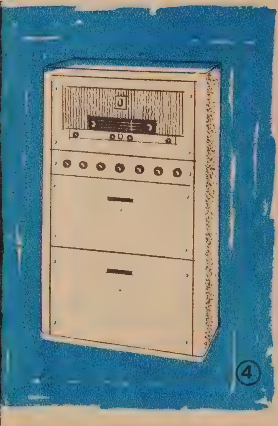

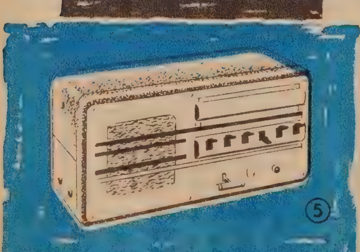

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e 2N308 transistor, mounted on a ev -lug tagstrip similar to the others. Mo ng from the front end of this tagtri the connections are: Supply lug, ar (support), collector, base, emitter, ar (support also) and earth again.

the right of this strip again is F , and finally a small four-lug tagtri supporting the detector diode and o ponents. Another small five-lug tagtri is visible directly in front of IFT2, up orting the AGC detector circuit. The ec nd and fourth lugs of this strip are n ed, with the centre lug earthed and he nd lugs used to support the diodeap citor junction (left end) and the AC line (right end).

T GSTRIPS

ll another small 5-lug tagstrip is se at the front of the chassis at the ig of the volume control. This serves rminate the audio end of the 10K er resistor connected to the pot. n ng arm, the tone control end of he 0.1 mfd capacitor, and the 220 ohm up ly line dropping resistor.

he volume control used has a doubleo switch fitted, and is used to switch he battery connections to the set. It h serves as a normal "on-off" w ch.

he wiring of the prototype was carie out using the "point-to-point" techi ce, which results in short ,direct leads n all signal connections. We recomne d that readers use the same system, nsure good results. Earth connecio should be made directly to the h sis, using the shortest path possible.

hen the assembly and wiring of the et is completed, it will have to be li ed. Since the final performance of h set will depend to a great extent p the alignment, a few words on h correct procedure would seem to be n rder.

he main requirement in the alignm t of a set of this type is a reliable i al generator or modulated oscillao This should preferably have an f ctive attenuator, and be fitted with ummy aerial. For convenience, it m be connected via the dummy aerial o he aerial and earth terminals of the e for the complete alignment procedu e.

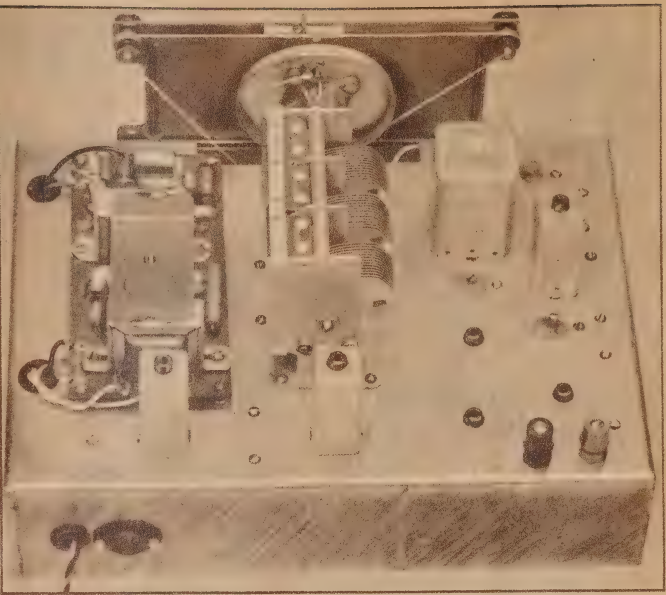
irstly, set the signal generator to Kc/s and a fairly high output. The e should be switched to the broadcast d to allow a reasonable amount of i al to reach the IF strip. The slugs o IFT2 should now be adjusted for x imum output, as measured by a DC r er at the volume control or an outp meter at the voice coil if modulai n is used. In the absence of a meter, a ough idea may be formed by ear.

AKING UP

Vith IFT2 adjusted for a maximum, l slugs of IFT1 should be similarly a usted. If the peak is vague or the n se from the speaker is inconvenie ly loud, the generator input should reduced.

With this done, the IF has been aligne The generator should now be set 700 Kc/s, and the dial of the set s ilarly adjusted. Maximum output n y then be obtained by adjusting the c illator, RF and aerial coil slugs (in t t order).

Turning both generator and receiver l to 1400 Kc/s, again find the maxi m m signal setting, but this time by justing the oscillator, RF and aerial RIMMERS.



The rear view of the set. The audio board is identical to the ones used in the "Transistor Stereo Player" of December, 1960. Note the use of sealing wax to fix the coil slugs in position after alignment. This prevents vibration from upsetting adjustment.

This completed, return again to the 700 Kc/s point of both generator and dial and make sure that this setting is still correct. If it requires slight adjustment, do so by means of the slugs.

When you are satisfied that maximum sensitivity is being obtained at both the low and high calibration points, this band may be regarded as O.K. The other two bands may be aligned in

PARTS LIST

1	Chassis 10½ x 8in x 2½in. Passivated cad. steel or sim.
1	Set of coils and IFT's to suit.
1	Output transformer, 84 ohms centre-tapped to 3.5 ohms.
1	Driver transformer, 3K to 2K centre-tapped.
1	Three-gang tuning capacitor, 415 pF max. per section.
1	Printed circuit audio board.
1	12-pole 3-position rotary switch (see text.)
9	Mica trimmers, approx. 6-40 pF.
1	Tuning dial assembly.
1	4-pin speaker socket and plug to suit.
1	Speaker 3.5 ohms, to choice.
	TRANSISTORS
	2N370, 2N371, 2N372, 2N308, 2-2N408, 2-N2175.
	DIODES
	2-OA80, GEX35 or GD4.
	RESISTORS
1	2.7 ohms 1 watt.
1	10 ohms.
2	150 ohms.
1	220 ohms.
3	330 ohms.
4	470 ohms
1	680 ohms
3	1K.
1	3300 ohms 5%.
2	3900 ohms.
1	4700 ohms.
1	4700 ohms 5%.
1	5600 ohms 5%.
1	6800 ohms.
1	8200 ohms.
2	10K.
1	15K 5%.
1	68K.
1	68K 5%.
1	150K 5%.
1	220K 5%.
	10K (log) carbon pot with switch.
	50K (log) carbon pot.
	THERMISTOR
	CZ9A.
	CAPACITORS
1	33pF.
1	100 pF.
1	470 pF.
1	680 pF.
1	1000 pF.
2	2200 pF.
1	3300 pF.
1	4700 pF.
1	0.02 mfd.
1	0.039 mfd.
7	0.047 mfd.
7	0.1 mfd.
1	0.33 mfd.
1	2mfd. electrolytic, 6 VW.
5	50 mfd. 12 VW electrolytic.
1	64 mfd. 12 VW electrolytic.
1	75 mfd. 12 VW electrolytic.
	Except where marked, all capacitors are 100 volt working types.
	MISCELLANEOUS
	Miniature tagstrips (Cinch miniature series 745 or similar): 2 3-tag, 1 4-tag, 4 5-tag, 1 6-tag, 1 7-tag, and special long strip 6¼ long having 11-tags (9 insul.)
3	⅜in grommets, 2 spring terminals (1 red, 1 black), screws, nuts, washers, connecting wire.

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" EE. 16mfd. 450V.	5/- ea.
" EC. 24 mfd. 450V.	5/- ea.

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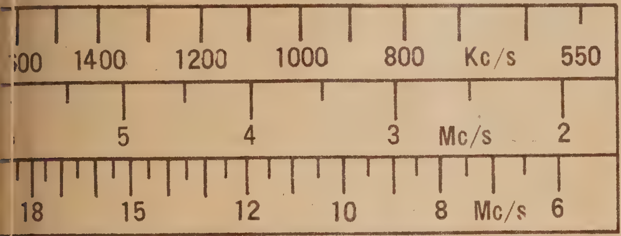
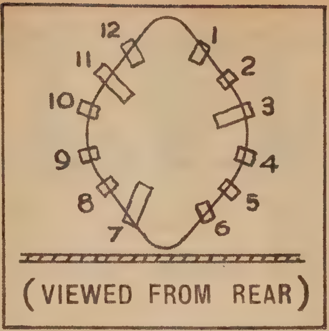
ilar fashion, using in each case bration point near each end of the For the 2-6 Mc/s band, points at Mc/s and 5 Mc/s are convenient. the highest band may be well d at 7 Mc/s and 15 Mc/s.

e main thing to keep in mind is rocedure of adjusting the low end e band first WITH THE COIL GS, and then the high end WITH TRIMMERS. The generator inshould always be kept as low as nient measurement will allow, to ve the risk of overload and consemasking of the correct peak.

te that we have included below a ize replica of the final dial scale, sponding to a standard EFCO 37 dial. As far as we are aware, nly dial glass available at present short-wave calibrations (shown in ront view) only has one band mark– and this differs somewhat from and used here. Suitable dial glasses possibly become available, however, wing this article.



case there should be a difficulty in obtaining a suitably calibrated dial ass, this diagram shows the three bands as they distribute across the face of a standard USL 37 dial.



By relating this diagram to the text and the underneath photograph, readers should be able to wire the wavechange switch exactly as in the prototype receiver.

point to watch when using the set serious listening — be sure to fit od earth as well as an aerial sys- Since battery sets cannot rely on sis-mains capacitance or direct ning via the mains system, performce will be marred unless a good is fitted. A convenient water pipe provide a satisfactory earth, in most s.

his completes the description of our band transistor receiver. In tests, as shown itself quite comparable commercial sets of the same type. a good aerial and earth system, it orms very well, and will provide y hours of comfortable "DX-ing," ddition to normal broadcast enterment.

COIL DATA

OADCAST BAND:

hese are commercial pi-wound types, dentical to those used in the original ransistor 8.

Mc/s BAND:

he aerial coil is wound on a ⅜in ormer, with the tuned winding 30 urns tapped at 5¼ turns. The 4-turn rimary is wound over the secondary t the core (or mounting) end.

he RF coil is also wound on a ⅜in ormer, and consists of 34 turns apped at 9¾ and 25 turns from the ore end.

he oscillator coil is wound on a ¼in ormer, and consists of 40 turns apped at 2 turns. An 8½-turn seconiary is wound over the main winding. fter first wrapping the latter with nsulating tape.

8 Mc/s BAND:

oth aerial and RF coils are wound on ⅜in formers as above, with the oscillator coil on a ¼in former.

The aerial coil consists of 11 turns tapped at 1¾ turns, with a 3½-turn primary wound over the core end.

The RF coil is an 11½-turn winding tapped at 3½ turns from the core end.

The oscillator coil is an 18½-turn winding tapped at ¾ turn from the core end, with a 1½-turn secondary centrally overwound as in the other oscillator coil.

GENERAL DATA:

The winding wire used for the 2-6 Mc/s band coils and all overwindings was 24 B and S enamelled and cotton-covered. That used for the main 6-18 Mc/s windings was 22 B and S enamelled. (We understand that Telecomponents Pty. Ltd. are making all coils available immediately.)

SWITCH WIRING DATA

AERIAL CIRCUIT WAFER (all numbers refer to diagram): Rotor on lug 3, RF transistor base. Rotor lug 7, aerial. Rotor lug 11, aerial gang stator.

RF CIRCUIT WAFER: Rotor lug 3, RF transistor collector. Rotor lug 7, mixer transistor base. Rotor lug 11, RF gang stator.

OSCILLATOR WAFER, REVERSE SIDE (facing front of chassis): Rotor lug 3, no connection. Rotor lug 7, mixer transistor emitter. Rotor lug 11, negative supply (for coil shorting, i.e., Slk.).

OSCILLATOR WAFER, SIDE FACING REAR: Rotor lug 3, oscillator gang stator. Rotor lug 7, emitter of oscillator transistor. Rotor lug 11, oscillator transistor collector.

GENERAL: Lugs 4, 8, and 11, broadcast band connections throughout, lugs 1, 5, and 9 are 2-6 Mc/s, and lugs 2, 6, and 10 connect to 6-18 Mc/s coils, etc.

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"	6SS7	16/6	"	6G6G	19/2	"	EF37A	21/3
"	6AD8	13/10						

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Switches, Oak S/S 3 pole, 3 position, various Spindle lengths, from ¼in to 1in	7/0
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Connectors, fuse flanged, complete M.F.	1/9
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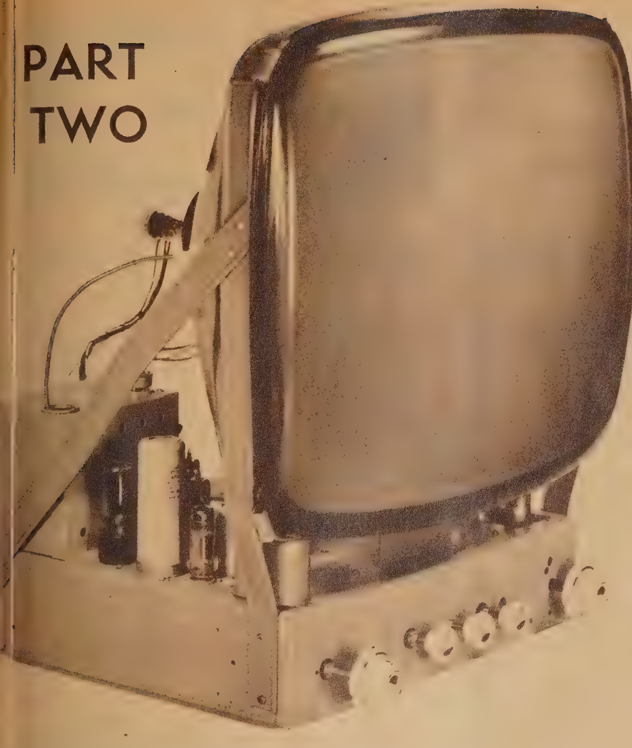

the conclusion of the construction detailed in this months's article, your eceiver will look very much like our prototype. Details of the aluminium ounting straps for the picture tube will be given at a later date for those desirous of mounting the tube in this position.

low To Build The 1961 TV Set

Last month we commenced the description of our new 1961 TV receiver, describing in detail those sections of the circuit necessary for the reception of the FM sound channels. In this issue we will deal particularly with the picture tube and associated deflection circuitry so that the picture information may be added.

By Alan Nutt

EFORE considering the circuitry in detail, it may be as well to refresh mories a little by discussing some of h fundamentals relating to picture ning and deflection circuits in genr.

TV image is built up from a raster horizontal lines. The image at the ismitter is scanned by an electron em, from side to side and downward, a specific rate, and the variations of t and shade transmitted as continu changes in carrier energy. Similarly, the receiver, an electron beam scans picture tube face in an identical pate, at the same time being modulated accordance with the received signal.

An essential requirement of the rever circuitry is that it provide the ans to scan the picture tube. For tralian standards it must scan horitally at 15,626 times per second, and tically at 50 times per second. This s achieved in practice by subjecting the electron beam to two magnetic fields, one deflecting it horizontally and the other vertically.

These magnetic fields are obtained from the horizontal and vertical oscillators and amplifiers, which supply a suitable sawtooth waveform to the deflection coils mounted on the neck of the picture tube.

Fairly obviously, it is essential that the deflection rate in both the vertical and horizontal directions be exactly in step with the scanning beam at the transmitter. For this reason, special synchronising pulses are transmitted along with video information so that both the vertical and horizontal oscilators are locked in step with the transmitter sweep oscillators.

One further point should be mentioned, namely the subject of interlace.

In order to create a moving picture it is necessary to transmit a series of still pictures in rapid succession. Provided we present these at a rate of about 16 per second, or higher, persistence of vision creates the impression of a continuous animated picture. The technique is similar to the presentation of motion picture film.

In TV transmission, 25 pictures or 'frames' are transmitted every second. Unfortunately, while being sufficiently rapid to produce the illusion of motion, the gap between successive pictures is still such as to cause an annoying visual flicker.

BANDWIDTH REQUIREMENTS

While this could be reduced by simply increasing the number of pictures per second, such a step would increase the required bandwidth in direct proportion. If we needed to double the picture rate (as we probably would) we would also double the bandwidth.

Spectrum space is far too valuable to be wasted in this way if there is a better solution, to say nothing of the possible effect on receiver design and economy. Fortunately, there is a better solution. By scanning each alternate line in sequence (i.e., 1,3,5,7, etc) we can scan the whole picture in 1/50 second, followed by a second scan interlaced with the first (lines 2,4,6,8 etc.) in the same period.

Thus, instead of 25 pictures per second of 625 lines, we have 50 pictures per second of 312.5 lines. There is no increase in bandwidth, but the viewer sees 50 pictures per second instead of 25, and and the flicker is reduced to negligible proportions. Reference to the accompanying diagram will indicate how the successive fields are interlaced to make a complete frame.

Although interlace is, fundamentally, a matter of transmitter standards, it can be less than perfect unless the receiver is properly designed and adjusted. Poor interlace results in adjacent lines either grouping together (pairing) or actually overlapping. This produces a coarse line structure and a loss of picture detail.

So much then for the theory. We now come to the circuitry in detail which consists of the two sweep oscillators and their associated amplifiers, sync. separator stage, and horizontal and vertical sync. amplifiers. The EHT supply is an integral part of the horizontal output stage and will be dealt with in conjunction with this part of the circuit.

In addition, a triode DC restorer circuit is included which permits clamping the average "black" level of the video signal.

The vertical oscillator and output stages are combined in one valve envelope, namely a 6EM7. The oscillator

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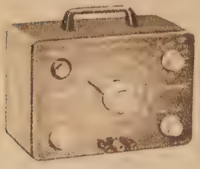
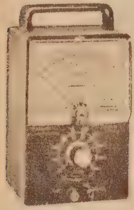


Acurately checks all types of condensers

HEATHKIT C-3 CONDENSER CHECKER KIT

Check unknown condenser and resistor values quickly and accurately as well as their operating characteristics with this fine instrument. Capacity measurements are made in four ranges—0.0001 mfd. to 1.000 mfd. Measures resistance from 100 ohms to 5 megohms in two ranges. All values read directly on the calibrated scale. An electron beam "eye" tube indicates balance and leakage. Leakage test provides switch selection of five test voltages, 25 volts to 450 volts DC. Spring return test switch eliminates shock hazard to operator by automatically discharging condenser after test. For safety of operation the circuit is entirely transformer operated. Wgt. 7lb.

PRICE: £23



High quality audio vacuum tube voltmeter

HEATHKIT AV-3 AUDIO VTVM KIT

This high quality AC vacuum tube voltmeter employs a tried and time-proven circuit featuring high stability, sensitivity, and broad frequency response.

SPECIFICATIONS

Frequency Response: plus and minus 1 db, 10 cps to 400 kc, .01 volt through 100 volt ranges. Plus and minus 2db from 10 cps to 40 kc, 300 volt range.

Sensitivity: 10 millivolts full scale (lowest range).

Range:

Volts: 0.01, 0.03, 0.1, 0.3, 1, 3, 10, 30, 100, 300 volts, RMS, full scale.

Decibels: Total range —52 db to plus 52 db. Scale —12 to plus 2 db. Ten switch-selected ranges from —40 to plus 50 db.

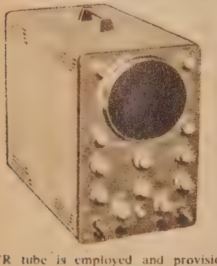
Input impedance: 1 megohm at 1 kc.

Accuracy: Within 5% of full scale.

Operates from 105-125v, A.C., 50 60 cycles.

Wgt.: 6lb. Size. 7⅜" x 4¾" x 4⅛".

PRICE: £36/12/-



HEATHKIT OM-3

"General Purpose" 5in.

OSCILLATOR KIT

Packed with "extras" seldom found in a scope at this low price, the OM-3 features wide vertical amplifier frequency response extended sweep generator operation and excellent stability. Vertical amplifier frequency response is within plus or minus 3db from 4 cps to 1.2 mc with sensitivity of 0.09 volts rms per-inch at 1 kc, while the sweep generator functions reliably from 20 cps to over 150 kc.

Both vertical and horizontal amplifiers are push-pull types. A 5BP1 CR tube is employed and provision is made for external or internal sweep and sync. Other features include a built-in one volt peak-to-peak reference voltage, a calibrated grid screen, an adjustable "spot shape" control to assure a sharp trace and a step attenuated, frequency compensated vertical input circuit. Operates from 105-125 V A.C., 50 60 cycles. Wgt. 22lb. 8⅝" x 14⅛" x 18".

PRICE: 44/12/-

HEATHKIT CT-1

In-circuit

CAPACI-TESTER KIT

This handy kit checks capacitors for "open" or "short" right in the circuit. Detects open capacitors from about 50mmf. not shunted by an excessive low resistance value. Checks shorted capacitors up to 20 mfd (not shunted by less than 10 ohms). (Does not detect leakage nor check electrolytic condensers.) Checks all bypass, blocking and coupling capacitors of the paper, mica and ceramic types. Uses an electron beam "eye" tube for quick indication.

Operates from 105-125V. AC. 50-60 cycles. 5 watt. Wgt.: 5lb. Size: 7½" x 5½" x 4".

PRICE: £8/19/-

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HEATHKIT GD-1B GRID DIP METER KIT

The Heathkit GD-1B can be used either as an oscillator or absorption wave meter. Align I.F. stages, adjust traps, filters, and tuned circuits, use it in winding applications, tune up transmitters, etc. A phone is provided for listening to "zero beat." Has 500 uA meter variable sensitivity control. Prewound plug-in coils provide tinuous frequency coverage from 2 mc to 250 mc.

Operates from 110v AC, 50/60 cycles. **PRICE: 24/1**

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WF54/FP

ec on uses a high-mu triode in a con- er onal blocking oscillator circuit. The ut it stage utilises the low-mu section it suitable circuitry to ensure linear pe tion.

e vertical oscillator is of the con- er onal "blocking" type, being virtually le ical to our earlier circuit with one r wo minor changes. Feedback is bt ned from the secondary winding of he scillator transformer in the cathode a

GH EFFICIENCY

e of a triode output stage is only o ble with a wide angle deflection h because of the much improved ef- ci cy of the deflection coils on the o assembly. The coils are wound in oid fashion rather than the earlier dle" method.

e potentiometer in the cathode of he output stage adjusts the valve oper- i conditions over a small range and e by affects the vertical linearity of picture. The height is adjusted by e potentiometer in the HT supply lead e vertical oscillator, an increase in resulting in increased output to the e ction coils.

e .022 and .01 mfd capacitors in nction with the 22K resistor from e late of the vertical oscillator to the a de of the amplifier constitute an ional linearising network which is ff tive at the commencement of the a (top of the picture).

complex feedback loop is unneces- a with a triode output stage as it does o exhibit those characteristics which er to make a pentode stage non-linear n r these particular conditions. Quite ving is thereby effected in small ponents.

e vertical output transformer is an u type, especially designed to match e 6EM7 to the low impedance vertical e ction coils on the yoke assembly. ical retrace blanking is taken from e plate of the output stage via a simple lt to the control grid of the picture l.

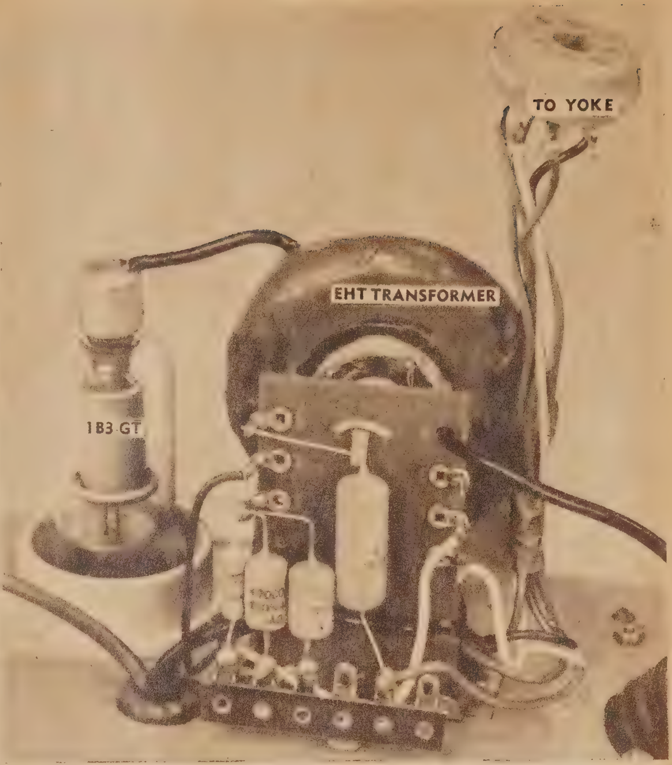
TERLACE TROUBLE

e had some trouble at first prevent- horizontal line energy upsetting the t lace of the raster. Eventually this a traced to line energy coupling from e yoke, back through the grid-plate a citance of the vertical output and s lator stages, and interfering with the e cal sync. pulses being applied to the s lator.

his is the reason for the capacitors m both grids of the 6EM7 to chassis. t essential that, if interlace is to be r erved, no horizontal oscillator or ut wiring comes close to the verti- a oscillartor or synch. circuits.

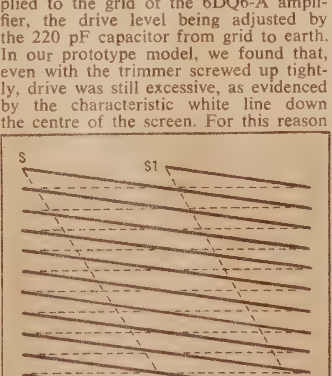
he horizontal oscillator is also of h blocking type, utilising one section f 6CG7. The circuit arrangement is e conventional, having been used in e ral of our earlier designs. The saw- h output voltage is developed across h .0012 mfd. capacitor between the com end of the sine wave oscillator c CHS1 and the cathode of the 6.

he sine wave coil is added to the uit as a stabilising medium, its effect g to steepen the slope of the oscil- r grid voltage as it approaches cut- f This means that noise pulses or er undesirable voltage pulses must have a considerably higher amplitude before they have an appreciable effect on the operation of the oscillator.



This photograph indicates clearly the method of mounting the components inside the EHT cage. When replacing the cover, ensure that the leads to the yoke socket are not lying against the EHT transformer.

The output from the oscillator is applied to the grid of the 6DQ6-A amplifier, the drive level being adjusted by the 220 pF capacitor from grid to earth. In our prototype model, we found that, even with the trimmer screwed up tightly, drive was still excessive, as evidenced by the characteristic white line down the centre of the screen. For this reason the 100 pF capacitor has been added in parallel with the trimmer.



Very much simplified, this diagram shows the general principle involved in obtaining an interlaced sweep of the transmitted picture. Two complete fields are shown which together constitute one complete frame. In practice, each field occupies 312.5 lines.

The horizontal output stage operates at a relatively high power level because, beside providing sawtooth current for the horizontal deflection coils, energy is also used during the flyback period to provide EHT voltage for the final anode in the picture tube.

The 6AU4 diode is included to act as a damper during the forward trace so that "ringing" in the deflection coils is supressed. The diode acts as a low impedance across the windings during the forward trace but as an open circuit during the retrace period, so that the retrace time is as short as possible.

HT BOOST

During the conduction period the diode is made to charge a capacitor in series with the HT supply and the diode, producing a resultant voltage higher than the normal HT supply. This boosted HT is used as the plate supply for the horizontal output stage, the vertical oscillator supply and the focusing anode supply.

The EHT rectifier is mounted in a special anti-corona socket because of the very high peak voltages involved. Filament voltage for this valve is obtained from a single turn loop around the core of the horizontal output transformer and most manufacturers supply the transformer with this winding already in place.

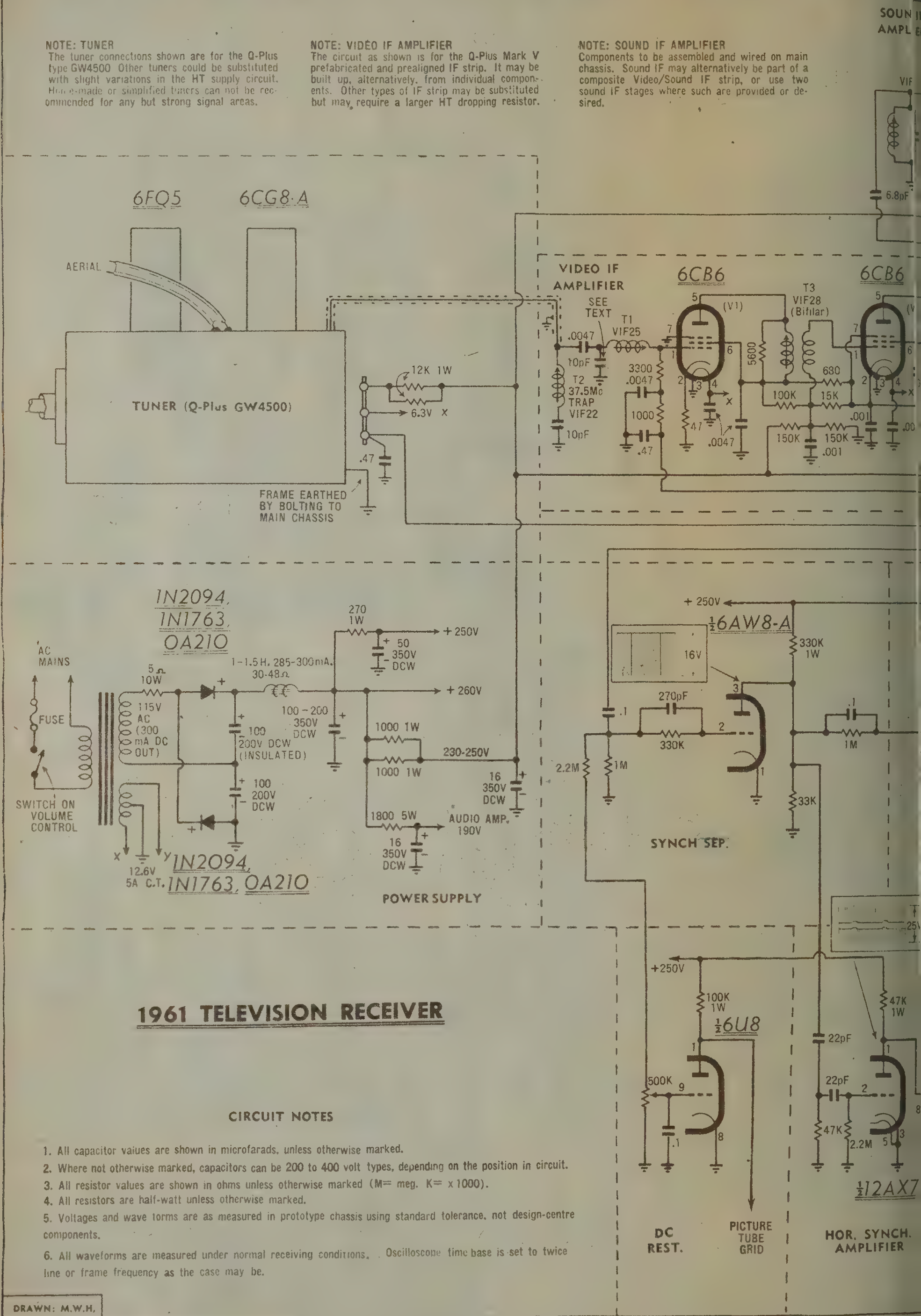
The width coil, CHW6, is shunted

CIRCUIT DIAGRAM OF OUR 1961 TV RECEIVER

NOTE: TUNER
The tuner connections shown are for the Q-Plus type GW4500. Other tuners could be substituted with slight variations in the HT supply circuit. Home-made or simplified tuners can not be recommended for any but strong signal areas.

NOTE: VIDEO IF AMPLIFIER
The circuit as shown is for the Q-Plus Mark V prefabricated and prealigned IF strip. It may be built up, alternatively, from individual components. Other types of IF strip may be substituted but may require a larger HT dropping resistor.

NOTE: SOUND IF AMPLIFIER
Components to be assembled and wired on main chassis. Sound IF may alternatively be part of a composite Video/Sound IF strip, or use two sound IF stages where such are provided or desired.

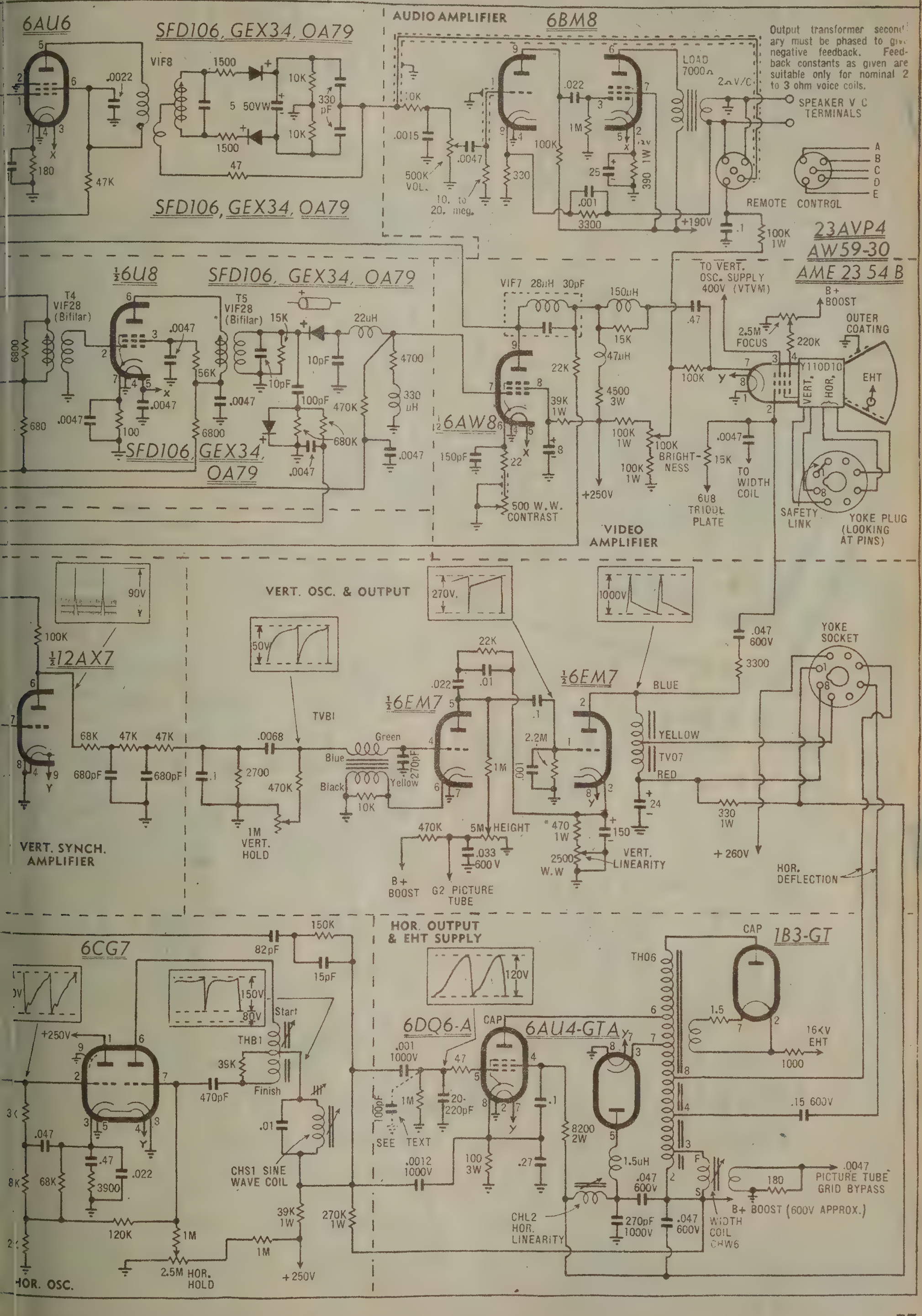

SOUN
AMPL
VIF
6.8pF
6FQ5
6CG8-A
AERIAL
TUNER (Q-Plus GW4500)
12K 1W
6.3V X
.47
FRAME EARTHED BY BOLTING TO MAIN CHASSIS
VIDEO IF AMPLIFIER
SEE TEXT
.0047
10pF
T1 VIF25
T2 37.5Mc TRAP VIF22
10pF
3300
.0047
1000
.47
6CB6
(V1)
.47
.0047
5600
T3 VIF28 (Bifilar)
680
100K
15K
150K
150K
.001
.001
6CB6
1N2094, 1N1763, OA210
AC MAINS
FUSE
SWITCH ON VOLUME CONTROL
5Ω 10W
115V AC (300 mA DC OUT)
100 200V DCW (INSULATED)
100 200V DCW
1-1.5H, 285-300mA, 30-48Ω
100-200 350V DCW
270 1W
50 350V DCW
+250V
+260V
1000 1W
1000 1W
230-250V
16 350V DCW
1800 5W
AUDIO AMP. 190V
16 350V DCW
12.6V 5A C.T.
1N2094, 1N1763, OA210
POWER SUPPLY
+250V
½6AW8-A
16V
330K 1W
270pF
330K
.1
2.2M
1M
33K
.1
1M
SYNCH SEP.
+250V
100K 1W
½6U8
500K
.1
DC REST.
PICTURE TUBE GRID
22pF
22pF
47K
2.2M
47K 1W
½12AX7
HOR. SYNCH. AMPLIFIER
DRAWN: M.W.H.

1961 TELEVISION RECEIVER

CIRCUIT NOTES

1. All capacitor values are shown in microfarads, unless otherwise marked.
2. Where not otherwise marked, capacitors can be 200 to 400 volt types, depending on the position in circuit.
3. All resistor values are shown in ohms unless otherwise marked (M= meg. K= x 1000).
4. All resistors are half-watt unless otherwise marked.
5. Voltages and wave forms are as measured in prototype chassis using standard tolerance, not design-centre components.
6. All waveforms are measured under normal receiving conditions. Oscilloscope time base is set to twice line or frame frequency as the case may be.

ALL IMPORTANT VOLTAGES AND WAVE FORMS



6AU6
SFD106, GEX34, OA79
VIF8
1500
.0022
5 50VW
10K
330 pF
180
47K
47
X
AUDIO AMPLIFIER
6BM8
LOAD 7000Ω
2ΩV/C
.022
1M
100K
330
.0015
500K VOL.
.0047
10. to 20. meg.
25
390 1W
.001
3300
+190V
.1
100K 1W
Output transformer secondary must be phased to give negative feedback. Feedback constants as given are suitable only for nominal 2 to 3 ohm voice coils.
SPEAKER V C TERMINALS
A
B
C
D
E
REMOTE CONTROL
23AVP4
AW59-30
AME 23 54 B
½6U8
T4 VIF28 (Bifilar)
T5 VIF28 (Bifilar)
6800
680
.0047
100
56K
15K
10pF
22uH
4700
330 uH
100pF
470K
680K
VIF7 28μH 30pF
150μH
15K
47μH
22K
4500 3W
39K 1W
½6AW8
150pF
22
500 W.W. CONTRAST
+250V
100K 1W
100K BRIGHTNESS
.47
TO VERT. OSC. SUPPLY 400V (VTVM)
B+ BOOST
2.5M FOCUS
220K
OUTER COATING
Y110D10
VERT.
HOR.
EHT
15K
TO WIDTH COIL
6U8 TRIODE PLATE
SAFETY LINK
YOKE PLUG (LOOKING AT PINS)
VIDEO AMPLIFIER
90V
100K
½12AX7
68K
47K
680pF
VERT. SYNCH. AMPLIFIER
VERT. OSC. & OUTPUT
50V
.0068
2700
470K
1M VERT. HOLD
TVBI
Green
Blue
Black
Yellow
270pF
10K
270V.
22K
.01
.022
½6EM7
1M
470K
5M HEIGHT
.033 600 V
B+ BOOST
G2 PICTURE TUBE
1000V
2.2M
470 1W
2500 W.W
150
VERT. LINEARITY
BLUE
YELLOW
TV07
RED
24
330 1W
+ 260V
.047 600V
3300
YOKE SOCKET
HOR. DEFLECTION
6CG7
+250V
150V
80V
THB1
Start
Finish
35K
470pF
.01
CHS1 SINE WAVE COIL
82pF
150K
15pF
.047
.47
3900
.022
68K
120K
1M
2.5M HOR. HOLD
39K 1W
270K 1W
+250V
HOR. OSC.
HOR. OUTPUT & EHT SUPPLY
120V
6DQ6-A
CAP
6AU4-GTA
.001 1000V
47
1M
20-220pF
100pF
SEE TEXT
.1
8200 2W
100 3W
.27
.0012 1000V
1.5uH
.047 600V
270pF 1000V
.047 600V
CHL2 HOR. LINEARITY
TH06
1B3-GT
1.5
16KV EHT
1000
.15 600V
WIDTH COIL CHW6
180
.0047 PICTURE TUBE GRID BYPASS
B+ BOOST (600V APPROX.)

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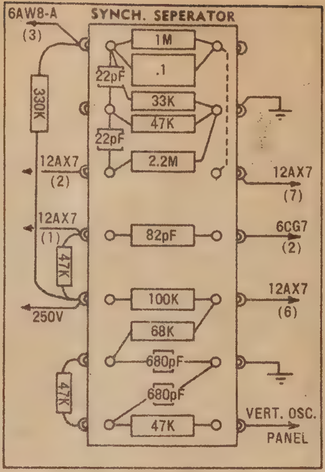
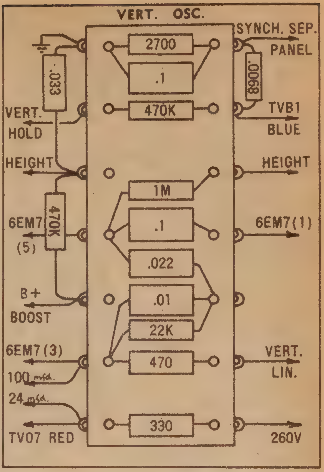




ross the lower section of the output ansformer in such a manner that it n vary the inductance of the winding d hence the amount of output to the rizontal deflection coils. It will have nimum effect when its own inductce is maximum.

In order that line retrace energy will t be apparent on the screen, a horintal blanking pulse is obtained from small auxiliary winding on the width il and applied to the control grid of picture tube in the same manner as vertical retrace blanking pulse. Both se pulses are negative-going and cut the electron beam during the retrace riod.

C RIPPLE VOLTAGE

The amount of voltage across the capacitor charged by the damper diode varies as the capacitor is alternately charged and discharged. This varying voltage may be considered as an AC ripple voltage in the HT supply to the output valve. A small change in the operating characteristics of the 6DQ6 may be obtained by varying the phase of the ripple voltage in the plate circuit with respect to the sawtooth grid voltage. This, in effect, gives some control over the horizontal linearity.

Linearity is varied by means of the coil CHL2 which acts as a filter for the AC ripple voltage, in conjunction with the .047 mfd capacitor from the bottom of the output transformer to the B plus line. Varying the inductance of this coil effects slightly the linearity in the centre of the picture.

Coming now to the synchronising circuitry, it will be observed that both sync. and video information are applied to the triode section of the 6AW8-A which acts as a sync. separator. Plate voltage and bias on this stage are adjusted so that only the high level sync. pulses, corresponding to modulation levels in excess of 75 per cent, are amplified.

A differentiating network, consisting of two series-connected 22 pF capacitors and a 47K resistor to earth is included between the output of the sync. separator and the grid of the horizontal sync. amplifier. This network changes the rectangular shape of the pulses into sharp spikes, suitable for synchronising the blocking oscillator.

CONTROL VOLTAGE

Output from the horizontal sync. amplifier is fed to the grid of the 6CG7 synchroguide valve in conjunction with a sample of the horizontal oscillator output. The relative phasing of these two voltages determines the amount of D control voltage developed across the 22K resistor at the lower end of the cathode network. This control voltage is connected to the grid of the oscillator tube, where it locks the oscillator frequency to that of the sync. pulses by varying the grid bias point.

The free running or non-synchronised frequency of the oscillator is controlled by the potentiometer in the grid circuit which adjusts the amount of initial bias on the oscillator valve.

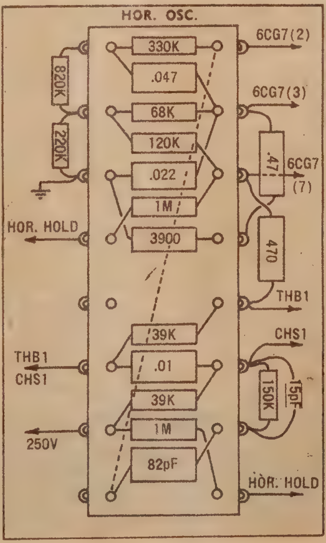
The vertical sync. pulses at the output of the sync. separator are passed on to a separate amplifier stage having an integrating network in its output circuit. The action of this network is to store portion of the charge from each successive vertical sync. pulse so that, approaching the end of the vertical sync. pulse chain, a total charge level is reached which will trigger the vertical blocking oscillator at the correct point.

The free running frequency of the vertical oscillator is controlled by the 1 meg. potentiometer in the grid circuit, which varies the RC time constant and hence the oscillator frequency.

The operating conditions of both horizontal and vertical sync. amplifiers are so chosen that the sync. pulses are effectively clipped, thereby making the output amplitude virtually independant of noise pulses. This adds considerably to the stability of the oscillator circuits, particularly in noisy areas.

The remaining sections of the receiver deal with the application of the video signal to the picture tube and the circuitry necessary for the presentation of a good quality picture.

As mentioned earlier, the video signal from the plate of the video amplifier is coupled via a .47 mfd. capacitor to the cathode of the picture tube. The action of the video signal voltage is to change the instantaneous bias on the picture tube and hence the intensity of the electron beam leaving the "gun" assembly and striking the screen.



The brightness control is used to set the average brightness level of the picture by adjusting the fixed bias voltage appearing between grid and cathode. Increasing the bias produces a darker picture and conversely, decreasing the bias produces a brighter picture. However, more on the function of this control in a moment.

The focus control simply supplies an adjustable voltage for the focussing anode of the tube so that the electron beam from the gun may be correctly focussed on to the screen of the tube.

One point remains to be discussed before proceeding with construction details. This concerns the DC restorer circuit, which plays an important part in picture quality. Again, a little refresher course on the theory involved will not go amiss at this juncture.

CORRECT BLACK LEVEL

The problem is that of maintaining correct picture brightness or, more correctly, maintaining the correct black level. If the reproduced picture is to retain the same brightness values as the transmitted picture, a signal representing black at the transmitter must produce black at the receiver, regardless of the video energy representing the scene.

In other words, we must have a brightness reference level which can be maintained right through the transmission and reception process up to the grid of the picture tube. This reference is known as the DC component and is taken as the black level, which is approximately equal to the blanking or "pedestal" level.

Black level at the receiver occurs at the point where the picture tube grid bias just cuts off the electron beam to the screen. Thus it may be seen that, if the black level at transmitter and receiver is to correspond, the pedestal voltage of the video signal must be sufficient to cut off the picture tube beam current.

At the transmitter, a DC component is present in the video signal so that all the pedestals are lined up at a fixed level corresponding to 75 per cent modulation. This is maintained through the

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and IF stages in the receiver, because full picture carrier is being amplified, th symmetrical excursions in each ccessive half-wave.

In passing through the video detector, original modulation is extracted, nplete with the "DC information" ating the position of individual video cursions relative to the pedestal level.

To present this video-plus-DC information accurately to the picture tube d or cathode requires the use of ect or DC coupling through the video plier and—what is somewhat less vious—an AGC system which is not cted by video content. Both requirents pose difficulties in a simplified eiver design.

C COMPONENT LOST

f, alternatively, the video-plus-DC nal is passed through a resistance-acitance coupling network, the DC nponent is lost. While the system will reproduce a recognisable picture, the ious tones will no longer automtically retain their correct values. is, black may be reproduced as grey, y as white, and white as washed out as devoid of detail. Conversely, white y be degraded to grey, grey to black, true black to "blacker than black."

Nor is it sufficient to attempt correc by means of the brightness control, ause any one setting will remain rect only so long as proportion of k to white in the picture remains stant. If this changes, the black level changes.

While ever the video signal retains DC component, the black level will represented by a constant value of with other tones as varying values DC relative to it. But once the DC ponent is lost, the signal is an AC veform. The reference now is the rage" value or "zero axis," repreed by a line through the waveform n dividing it into equal areas above n below the line. The black level is longer pegged, but varies about this rence according to the video content.

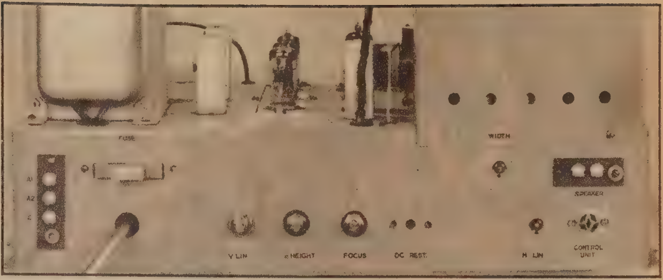
GHTNESS CONTROL

ow let us consider the operating conns of the picture tube. Bias is applied the brightness control circuitry and, he absence of the DC component, is the only factor which will control ture brightness.

nsidering these two facts together, s imagine a video signal (minus DC ponent) applied to the picture tube. h point to be appreciated is that the axis of the signal will always correpd to the working point of the picture t, as selected by the brightness trol.

rther, let us assume that the video gl represents equal areas of black white (medium energy level). By ctly setting the brightness control, nay so locate the zero axis, relative e cut-off bias of the picture tube, transmitted black does, in fact, drive grid to cut-off and produce black.

t what happens if the scene sudchanges to predominently black? zero axis will now lie close to the level but, since it is also pegged he previously selected operating , the black level is nowhere near ff and we have no black in our e. For correct reproduction, the ting point should now be shifted ds cut-off as, for example, by reg the brightness control.



The layout of the preset controls and terminal strips is indicated in this rear photograph. The DC restorer control may be a normal potentiometer if desired. If a remote control unit is not envisaged, the relevant socket may be deleted with no change in circuitry.

Naturally, it is hardly practicable to follow every change of scene with a manual brightness adjustment but, had we retained the DC component, it would have performed this job for us. In other words, the DC component enables the black level to be our reference point, rather than the zero axis, as occurs when we lose the DC.

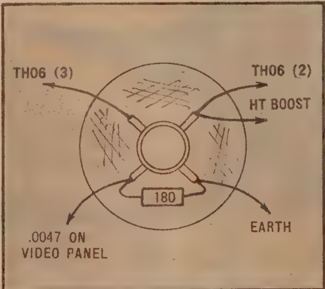
Failing actual retention of the DC component, we can achieve much the same effect by restoring it artificially, or by "DC restoration." We do this by generating a DC voltage from the video signal, of suitable polarity and amplitude, and applying this to the picture tube so as to shift the operating point as already described.

RESTORER CIRCUIT

There are many ways in which this may be achieved in practice, but the circuit we have chosen has proved itself to be a simple, effective and reliable arrangement. It takes advantage of the fact that a suitable DC voltage is already present in the receiver, at the grid of the synch separator stage. All we have to do is amplify it, DC wise, and apply it as a control voltage to the picture tube grid.

More precisely, and referring to the circuit, we make use of a spare triode section of a 6U8 as the restorer valve. Its grid is connected to the grid of the synch seperator stage, and suitably decoupled to remove actual video information. Its cathode is earthed and its plate connected to the HT line through a 100 K resistor.

The grid of the picture tube also connects to this plate, the picture tube cathode having been "jacked up" by a suitable value of positive voltage, via the brightness control, so that the grid is still effectively negative by the required amount. Thus the instantaneous brightness is governed by the voltage developed at the plate of the DC restorer valve and which is governed, in turn, by the bias on its grid.



These are the connections for the width coil looking at the end carrying the lugs. The secondary or flyback suppression winding may be easily identified with an ohmmeter, as it has considerably less DC resistance than the main winding.

For a predominently black picture this bias will be minimum, the restorer valve will draw maximum current, the plate voltage will drop, and the picture tube grid will receive a less positive (more negative) bias. This moves the black level towards the cut-off value as required.

A predominently white picture will produce the opposite effect. A high bias at the restorer grid, minimum plate current, maximum plate voltage, and a more positive (less negative) bias to the picture tube grid. Thus the working point will be moved away from cut-off so that the black level of the higher amplitude signal will just reach it, but not go beyond it.

The amount of control may be preset by means of the .5 M potentiometer, and there is sufficient voltage to permit over control if necessary. Thus, it is possible to compensate for limitations of the AGC system, as well as the original loss of DC component.

CONSTRUCTION DETAILS

Passing on now to the construction details, the majority of small components for each section are mounted on panels in the manner described last month. The layout detail for these panels is given in the accompanying diagrams and we suggest that they be wired as the first step.

The potentiometer controls may now be mounted in their respective positions on the front and rear walls of the chassis. The drive adjust trimmer is attached to the chassis next to the horizontal output valve socket. Be careful when wiring this trimmer that the plate making contact with the adjusting screw is the one that is grounded.

The vertical blocking oscillator and output transformers are mounted above the chassis in the position indicated in the photograph. The leads from both transformers are brought through grommetted holes in the chassis to their respective connections on the 6EM7 socket.

The horizontal oscillator coil is mounted between the horizontal oscillator socket and the sync. separator

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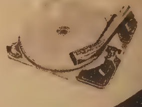

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nel. The sine wave coil is mounted tween the horizontal output socket d the horizontal oscillator panel.

The final piece of "hardware" is the rizontal output transformer which is unted on top of the chassis next to anti-corona socket for the 1B3-GT T rectifier. A five lug tag strip is unted on the chassis at the base of transformer terminal board and car- s the B plus boost capacitors, the ies capacitor to the deflection coils d the 270K resistor to the oscillator lve.

Commence wiring from the video am- fier through the sync. separator ampli- r stages to the vertical oscillator. The d from the output of the intergrator twork to the vertical oscillator is con- cted straight across the gap between two adjacent panels.

AG STRIP MOUNTING

The components associated with the d circuits of the sync. separator and restorer are mounted on two four- tag strips adjacent to the video ampli- socket. An examination of the otograph will indicate the position arly.

The 3.3K resistor and 0.47 capacitor plying the vertical blanking pulse are unted on a four-lug tag strip under- th the vertical output transformer.

The horizontal oscillator wiring will sent no problem if it is remembered keep all leads containing line energy l away from the vertical oscillator sync. amplifier stages. Cathode and een components for the horizontal put stage are mounted on a five-lug strip next to the socket. The 47 h grid suppressor should be con- ted to the socket pin with a minimum ead length.

two-lug tag strip is mounted next he damper diode socket and carries "spook" suppressor choke and 270 bypass capacitor.

ERRATA IN PART 1.

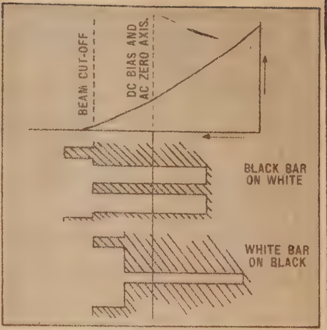
For the Q Plus tuner specified, he HT dropping resistor should be wo 12K, 1W units in parallel and ot two 27K as shown in the chematic.

The reference to changes in udio feedback components in the entre of page 50 should read, —and the capacitor reduced to 70 pF."

me care should be exercised when g the EHT cage assembly as stray lying against the EHT transformer ctifier can lead to corona discharg- hich in time will completely destroy nsulation of both wire and/or trans- er.

e leads to the yoke socket at the of the cage cover should be left enough so that the cover may be removed. However, it is a wise ution to lace the cables together the cage with a length of small ter PVC sleeving. This will con- bly stiffen the wiring and prevent gging against the transformer with ossible results mentioned in the pre- paragraph.

bber grommets must be used for the holes through the chassis, par- rly for the leads carrying the heater voltage from the EHT transformer to the 1B3-GT, and the EHT lead from the rectifier back up through the cage to the ultor of the picture tube.



Showing how two frames containing different video information will appear when applied to a picture tube having a fixed DC bias. Note that the black level of the lower frame has insufficient amplitude to drive the tube to cut-off. The method of correcting this condition is discussed in the text.

Incidentally, these wires should preferably have double insulation, a good idea being to take a length of small diameter co-ax such as PT9M, remove the outer sheath carefully and slide off the braid. The inside PVC insulated core may then be slipped back into the outer sheath with little trouble.

EHT RECTIFIER

The 1.5 ohm heater dropping resistor and the 1K EHT filter resistor are both mounted across the bottom of the 1B3-GT socket, utilising some of the blank pins. The heater resistor is mounted between pins 6 and 7, the heater leads from the EHT transformer going to pins 2 and 6. The 1K resistor may be connected from either pins 2 or 7 to pin 4 from which point is taken the EHT lead to the picture tube ultor.

The yoke assembly will normally be purchased with the leads already terminated in an octal plug. A safety link must be added to this plug, however, by joining pins 1 and 2 with a short loop of insulated wire. This link breaks the HT to both vertical and horizontal output stages if the yoke is removed from the socket.

All the leads to the picture tube socket may be laced together for neatness with the exception of the cathode lead. This should be run separately in order to reduce stray capacity effects

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hich can upset the video response.

After terminating the EHT lead in ı ultor clip and attaching the picture ıbe socket, carefully check the wiring ır possible errors. It may be a good ea to leave the checking for several ours and undertake the task when feelg fresh. It is surprising the number of istakes that can slip through unnoticed hen one has been working on a piece equipment for any length of time.

If everything appears to be in order, e yoke may be plugged into the socket ı top of the EHT cage and the set ritched on. At this point we are only terested in the operation of the horintal circuitry and the EHT supply rived from it.

OLTAGE CHECK

Make sure that the EHT lead is well ear of surrounding objects and, after normal warm-up time, the EHT volte may be checked. If facilities are ailable the voltage may be measured, d should be in the vicinity of 15kV. therwise, an alternative test may be ployed.

Carefully pick up the EHT lead several hes away from the ultor clip and ng the end of the cable close to the tal chassis. A definite "fizz" should audible at a distance of about one h and at a distance of a ¼ to 3/8 an inch a spark should jump from l lead to the chassis, similar to an ition spark.

n order to check the picture quality l make the final adjustments, it will necessary to either mount the picture e on the chassis or, what may be re convenient at this stage, carefully port the tube on the bench or table t to the chassis.

If the latter course is followed every re must be taken to see that the tube adequately and safely supported and fe from accidental knocks or atches. Yoke, ultor, and socket ds must not place any strain on the k of the tube.

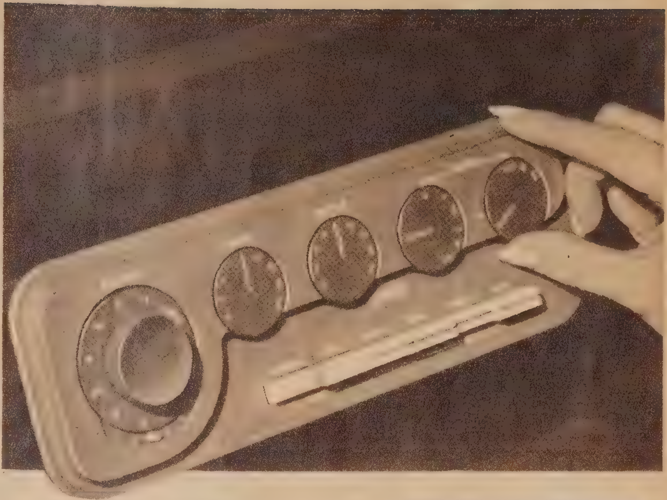
he yoke assembly must be pushed t up against the flare at the end of neck, and rotated so that the two idal magnets are at either side. The ip may be tightened slightly to pre- slip but not so tight as to prevent er adjustment later.

PASS CAPACITOR

he graphite coating on the outside of e picture tube bulb must be grounded s this forms one plate of the EHT by ss capacitor. If the tube is mounted on he chassis, a length of braid held ly across the coating by a spring be the best arrangement. If the tube tting on the bench, however, some r arrangement will have to be made.

ssuming correct alignment as described st month, it should now be possible ljust the horizontal and vertical con (including the sine wave coil) to the where the picture locks, even gh other adjustments may still be sary. These include finer adjust of the sine wave coil, sizing ing, vertical and horizontal linear ocus and DC restoration.

se will be covered in detail next h, together with a description of tube mounting assembly. If space its we may also discuss remote con units, including channel selection ns.



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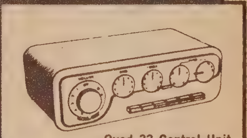
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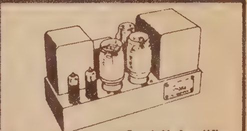
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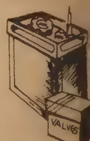

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6AG5 .	3/9
6AG7 .	12/6
6AJ5 .	5/11
6B4 ..	10/6
6C4 ..	3/11
6C8 ..	3/11
6F7 ..	12/6
6F8 ..	12/6
6G6	5/11
6H6 ..	1/6
6J5	12/6
6J6 ..	12/6
6J7 ..	12/6
6K6 ..	6/9
6K7 ..	3/11
6K8 ..	6/9
6L7 ..	3/11
6N7 ..	9/6
6Q7 ..	12/6
6R7 ..	12/6
6SC7 ..	12/6
6SF5 ..	7/6
6SH7 ..	2/3
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6-volt A.W.A.
Vibrators. suitabl
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Charge your battery while it's still i
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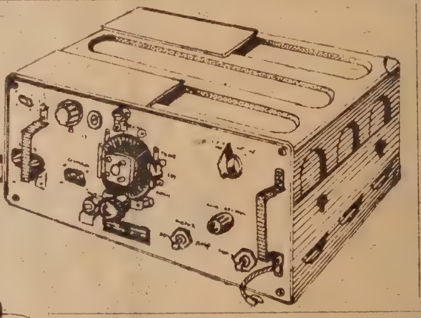

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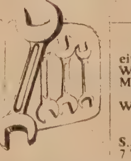

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With normal, and extra fine tuning knobs.
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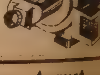

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MUSIC-BOX MOVEMENTS.

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ieal working models, ıplete with Build-it-rself" instructions.

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ALL FOR ONLY 33/9.
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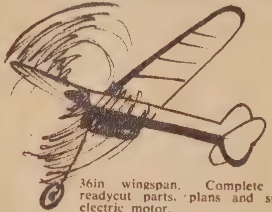

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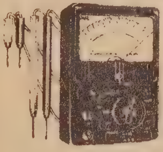

For checking household electrical appliances, garage equipment, etc. 2,000 ohms per volt sensitivity. All voltages from 0-1,000 AC DC. Also 0 to 500 micro amps: 0 to 500 milliamps and plus and minus 20 decibels.

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Price £3/19/6.
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S.A.E., drop forged, open end and ring set of five, **32/6.**
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Standard telephone replacement sets suitable for adapting to your own internal telephone system.

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6in inside calipers. **4/6**
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Set of seven hexagon keys.

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(Post 6d)

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0 to 1in, **18/6.**
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Both with zero error adjustment.
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1/9 each.
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Checks existence and and density of spark. Clips inside the pocket like an ordinary fountain pen.

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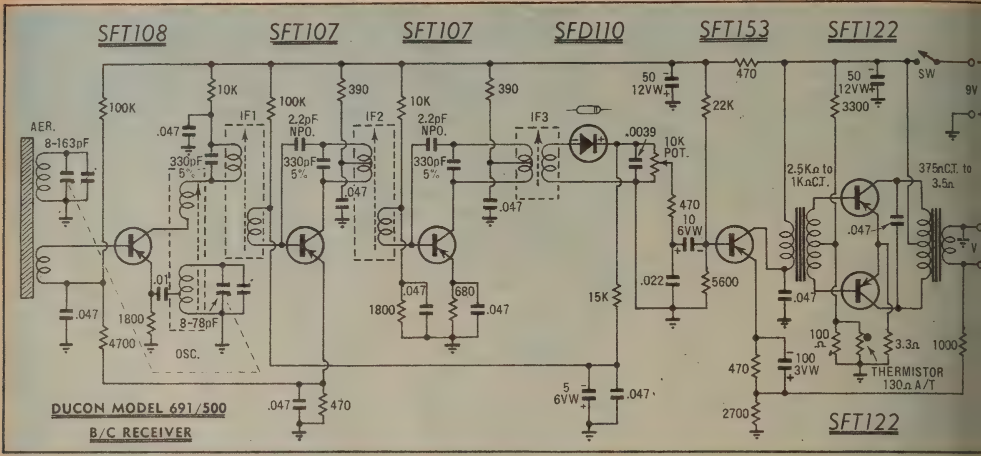
TRANSISTOR SET DESIGN DATA



This circuit from the Ducon laboratories is intended as a guide for anyone wishing to design a portable or personal portable receiver. Even with sub-miniature coils it is capable of a high order of performance.

The circuit shown above and the data given below are reproduced by courtesy of Ducon Industries Ltd. It is not intended as a constructional project, but rather as a typical circuit, designed by the company's engineers, to illustrate the correct use of their transistors and other relevant products. Of particular interest is the coil data based on Ducon Miniature IF assemblies, which is particularly suited for personal portable designs.

THIS receiver uses six transistors and one germanium diode and works from a 9-volt battery. It has been designed with the following points in mind:

(1) Economy.
(2) Good sensitivity.
(3) Good signal-to-noise performance.
(4) Freedom from overload.
(5) Ample audio output for both mantel and portable radio applications.
(6) Long battery life.

The following is a summary of the design and performance of each section, keeping in mind the above points. In choosing an audio power output, it must be remembered that the greater the maximum power, the higher the battery drain at any given output level. It is considered that the 450 mW output stage used in this receiver with a 6in x 4in speaker provides ample volume for both mantel and portable applications at a quite moderate battery drain.

CROSS-OVER DISTORTION

The .047 mfd collector to collector capacitor in the output stage is used to assist in reducing crossover distortion. The value is limited by the fact that this presents an additional load in parallel with the output, causing an increase in dissipation at higher frequencies. It is desirable that the overall response of the audio section be such as to prevent large amplitude high frequency signals from reaching the output stage. This high-frequency roll-off is provided at the collector of the driver stage.

Some 3 db of feedback is used to reduce distortion and production variations in audio gain and frequency response.

The frequency response has been adjusted in conjunction with the speaker for an overall response which gives pleasant sound with good articulation. Naturally, the cabinet design and the individual requirements of a manufacturer may make an alteration in response desirable. This can be achieved by altering the .047 mfd capacitor from the SFT153 collector to chassis.

TONE CONTROL

A tone control can be added if required by decreasing this capacitor to not less than .027 mfd and putting in parallel with it a series capacitance and potentiometer. A 0.068 mfd in series with a 5K potentiometer should be suitable as a tone control circuit.

AGC is derived from the detector circuit and a higher than "normal" potentiometer resistance has been used to assist in the development of the desired AGC characteristic. A higher AGC voltage can thus be developed when the volume control is turned down from maximum, without causing the early onset of AGC to affect the sensitivity.

Some AGC is effected in the converter stage by feeding its base bias circuit back to the emitter of the controlled IF stage. This assists performance in strong signal areas by preventing overload of the latter stage.

Transistor type SFT108 is used as a combined oscillator-mixer, and the following design points should be noted:

Under small signal conditions, t
converter stage operates with a low co
lector to emitter voltage to improve t
signal-to-noise ratio.

The oscillator injection is kept fai
high to maintain stable oscillations und
all conditions — especially under e
treme signal conditions where the co
verter current is reduced by AGC.

The aerial coil secondary winding h
been kept down to two turns to mainta
a high Q. The phasing of this windi
must be correct (see circuit and windi
details) otherwise tracking errors w
occur.

IF AMPLIFIER

The IF amplifier uses two SFT1
transistors. It has been designed in su
a manner that it will remain quite sta
for any combination of transistor pa
meter variations. This will facilitate p
duction especially where the IF amplifi
are prealigned.

In both the IF amplifier and elsewhe
several factors combine to ensure
minimum spread of overall sensitivi
in production. From measurements m
using specially selected transistors, it
anticipated that the maximum variat
between receivers will be less than 10
The factors which contribute to this

(1) Ducon transistors of
given type exhibit a relatively r
row spread in parameters.
(2) The IF transformers have b
designed in such a manner
transistor impedance parame
have a relatively small effect
the dynamic impedance at the
lector tap and hence on the st
gain.

The design is such that the volt
gain from base to collector of the
IF stages has been kept to a minim
to ensure good stability. This has resu
in a low input impedance to the sec
and third IF transformers. Hence, va
tions in transistor output impedance

t have any significant effect on the formance of these stages.

The loaded Q of these transformers is proximately half the unloaded Q. Varions in the input impedance of the lowing stage thus have a smaller effect impedance than when the loaded Q considerably less than half the unload- Q.

AIN FACTORS

Hence, the gain of each stage depends nost equally on the unloaded dynamic pedance of the tuned circuit and the ected input impedance to the follow- stage and on the transistor beta.

The unloaded Q is relatively constant. spread of Gm in Ducon transistors any given type is relatively small. The ut impedance to the third IF stage s not vary over wide limits for the con SFT107.

While the final layout will depend some extent on the individual manucurer's requirements, the following nts should be noted in regard to ility. A common cause of instabil- in transistor radio receivers is the -up in the aerial circuit of radiation n the detector. This has been avoided three means:—

) Maintenance of a high Q aerial uit.

) The use of an additional stage RF filtering at the detector. (The ohm resistor and .022 mfd capor).

) The original layout was designed ich a manner that the detector and tages were on the opposite side of board to the aerial rod.

r the benefit of those who may to experiment, the following coil is presented, commencing with the te rod aerial.

od — Ducon F214 — 8in x 0.330in.
ire — 9/41 B & S posyn litz.

e aerial coil can be wound directly he rod or separately on a former.

Coil wound directly on rod.

imary: 85 turns before adjustment.
ndary: 3 turns.

Coil wound on M.S.P. aerial coil er (37527).

mary: 84 turns nominal **Secondary:** ns.

CKING DATA

r satisfactory tracking, the innce of the primary must be within ange from 495 to 510 microhenries.

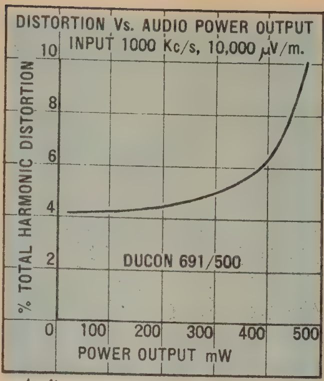
must be remembered that the ive permeability of the aerial rod vary slightly within a small tolerand hence it is desirable to adjust iductance in production whenever ple, or at least check when comng to use a new batch of rods.

start of the primary, which is arthed end, is positioned approxiy 2.5 inches from the end of the nd the coil is wound towards the . When a former is used, this on can be varied within plus or 0.75 inches to adjust inductance it affecting Q to any significant e.

n the primary is wound directly e rod, turns can be removed testing to give the required ince.

oth cases, the secondary is wound he first turns of the primary and same direction.

l the remaining coils (Oscillator, IF transformers) are wound on Ducon Miniature IF Assemblies, as follows:



Audio power plotted against distortion. The figure of 10% total for full output is a perfectly satisfactory standard for sets of this type.

OSCILLATOR COIL.

Primary: 5 turns 42 SWG. **Secondary:** 66 turns 42 SWG tapped at 2 turns wound over primary.

IF 1.

Primary: 68 turns 42 SWG. **Secondary:** 5 turns 42 SWG wound over primary.

IF 2.

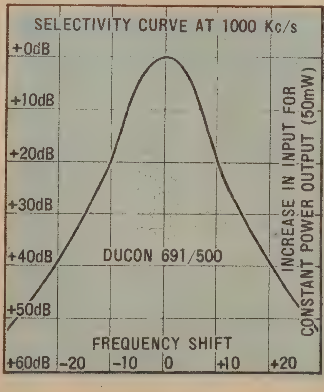
Primary: 68 turns 42 SWG tapped at 14 turns. **Secondary:** 7 turns wound over primary.

IF 3.

Primary: 68 turns 42 SWG tapped at 18 turns. **Secondary:** 20 turns wound over primary.

Just how well the requirements set out in paragraph 1 have been satisfied may be summed up by the performance figures issued for the prototype receiver.

Audio power output is 460 mW with 10 per cent distortion, dropping to 5 per cent at 300 mW. Battery consumption is 16 mA at zero signal, 70 mA at 460 mW, and 20 to 25 mA at average program level. This, according to Eveready data, should give a battery life of 500 hours for the type 286 and 330 hours for the 276-P, assuming 2 hours per day operation in both cases.



This selectivity curve shows what can be done with suitable miniature pot core assemblies. Even better results are possible if litz wire os substituted for solid wire.

Sensitivity ranges from 200 microvolts/metre at 600 Kc to 100 microvolts/metre at 1500 Kc. The overall frequency response is 3 db down at 300 cps and 2500 cps, and 10db down at 4000 cps.

The selectivity curve shown is based on the use of solid wire for the IF windings. While adequate in most cases, it is suggested that this could be improved by the substitution of suitable Litz wire.

Editor's note: What do these figures mean in more practical terms? How, for example, would this set compare with our own "Transporta Seven" of February 1959? In spite of the fact that the "Transporta Seven" is a larger set — it has one more audio stage — the comparison is not as unfair as might be imagined.

In most other respects, the two circuits are very similar. They use a similar converter circuit, the same number of IF stages and, apart from the one stage already mentioned, similar audio systems. This, and the fact that the original Transporta Seven was still available, made the comparison a logical one.

ALL STATIONS

As might be expected, the Transporta Seven showed a higher overall gain, but it is doubtful whether, in practice, this would mean very much. The Six was able to play all the stations audible on the Seven, the only difference being the setting of the respective volume controls. In short, although the Six had less gain to spare, it was still adequate.

Summing up, this would appear to be an eminently practical design within the limits of six transistors and may well prove to be a better compromise than anything larger. The fact that it can achieve this performance while using essentially sub-miniature coils, suitable for personal portables, makes it doubly attractive.

TV AIRPORT AID

IN order to survey a busy intersection at Britain's Southend Airport, not visible from the control tower, the airport authorities have installed a Marconi closed circuit television camera channel. The camera overlooks a main aircraft holding area and an important road and runway intersection.

Air traffic control officers in the tower, which overlooks the main apron and runway, were previously unable to supervise this "blind area." Now, throughout the day, the TV camera provides them with a "seeing eye" which is extremely useful in their day to day operations and greatly assists in the movement of aircraft and vehicles.

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22/6

GARRARD RECORD CHANGERS 3-SPEED 32 V.D.C.

New English Garrard Record Changers fitted with high fidelity turn-over Crystal Pick-up, Sapphire Needles. For 32-volt D.C. operation. Can be used on any D.C. voltage exceeding 32V with External Resistance.

£9/15/- F.O.R.

NEW 4-SPEED PLAYERS

With turnover Crystal Pick-up

£8/10/- POST N.S.W., 7/6. INTERSTATE, 12/.

NEW STEREO CHANGER, 4-SPEED. F.O.R. £12/1

NEW 4-SPEED STEREO PLAYER F.O.R. .. £10/10/

SLIDER-SWITCHES

10 pole 2-way silver plated contact
3/

BURGESS MICRO-SWITCHES

Can be wired to switch circuit on
off. 3/

SCOOP PURCHASE OF POTENTIOMETERS RESISTORS AND CONDENSERS

We have purchased the resistor and condenser stock held by Bush-Simpson who have ceased the manufacture of TV and radio equipment.

The resistors are mainly I.R.C. and include most standard values from 200 ohms to 5 meg. in ½, 1, and 2 watt. Also some wire wound. **List price £4/10/ per 100.**

The condensers are in most popular makes and include mica, ceramic, paper and electrolytic in most popular values.

List price £5/10/ per 100.

The potentiometers are all current types and include switch pots and dual concentric. **List price £6 per doz.**

SPECIAL PRICE

Resistors or condensers in boxes of 100 mixed values 20/. Post and packing 2/9.

Potentiometers, **25/ per doz.** Post and packing 2/9.

TAPE-RECORDER MOTORS

New Collaro Tape-Recorder Motors. 240 volt. A.C. Adaptable for many uses.

37/6 **Post extra.**

NEW 15 WATT AMPLIFIERS

These 15w P.A. Amplifiers using 6 valves, including EF86 Micro phone Pre-amplifier and 6BQ5 valves in push-pull, with Fergus Output Transformer with voice coil tappings of 2 to 15 ohms. Inputs for Microphone, Radio and Pick-up with mixing faciliti and tone control.

Unit supplied in Hammertone-finished metal case.

£18/17/6 **Post: N.S.W. 10/, Interstate 15/**

12in Rola Speaker for above (10 watt) 57/6.
Crystal Microphone for Amp., 47/6.

NEW 25 WATT AMPLIFIERS

As above but using 2-EL34 valves in push-pull output.

£26/17/6

Post N.S.W. 15/, INTERSTATE 20/.

CONTACT RECTIFIERS

Westinghouse Selenium Rectifiers, ideal for small sets or test equi ment. 120V A.C. 60mA output, 6/9, post free.

NEW VALVES AT BARGAIN PRICES

6J6	12/	EK32	6/9	1K5G	2/6	6H6GT	2/6	6AC7	5/6
1C4	7/6	6SA7GT	9/6	1M5G	3/	6K7GT	7/9	VR65A	2/6
1T4	4/6	6SH7	5/6	1K7G	3/	6U7G	5/	7193	2/
3S4	10/	1Q5G	2/6	1L5	9/6	7C7	3/6	12A6	5/
1R5	10/6	1P5G	2/6	6C8G	5/	78	7/6	EF50	2/6
1A7GT	9/6	1C7G	3/	6SS7	8/6	6B6G VR55	5/	12SH7	5/
1D8GT	9/6			6H6	2/6			6K7G	4/6
6K8G	6/9							955	2/6
6SJ7GT	9/6							954	2/6
12K8	10/								

Please add postage on all valves.

NEW VALVE SOCKETS: Ceramic EF50 sockets, 2/6 ea. American moulded Loctal, 1/ ea. Octal 8-pin wafe 6/6 doz. 5BP1 socket Ceramic, 7/6. Amphenol 5-pin ceramic, 2/6 ea. All post extra.

NEW MINIATURE COILS and I.F. TRANSFORMERS: Aerial, R.F. or Oscillator Coils, 7/6 ea. Post 1/-. I.F Transformers, 9/6. Post 1/-. Short Wave Coils, 16 to 49 metres, 5/6 ea.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. Phone LM7398

Making a TRANSISTOR PORTABLE or CAR RADIO?

Success assured with
R.C.S. COIL KITS
and PRINTED
CIRCUIT BOARD

COMPLETE KIT OF PARTS FOR ALL-TRANSISTOR CAR RADIO

As featured in June R & H

£27/7/6

TV TURRET-TUNERS

10 Channel Turret Tuners with two valves
£3/17/6, plus postage.

COMPLETE KIT OF PARTS FOR THE TRANSISTOR SEVEN

With NEW R. F. STAGE which increases Signal and reduces Hiss.

£25/17/6 SET WIRED AND TESTED £2/10/- EXTRA

Complete kit of parts for the Transistor 7, including 7 Transistors, Printed Circuit Boards, Coil Kit, Rola 5F Speaker and Transformers and all necessary parts to complete this set including attractive and durable two-tone cabinet with gold trim. Fitted with special aerial coil and plug to connect to your car aerial or external aerial making it an ideal car set or for use in the country.

POSTING AND PACKAGING EXTRA on transistor 7 sets. N.S.W., 15/-, INTERSTATE, 22/-.

NEW 4 SPEED RECORD CHANGERS

THESE NEW 4 SPEED RECORD CHANGERS ARE EQUIPPED WITH HIGH FIDELITY CRYSTAL PICK-UP AND SAPPHIRE NEEDLES. CAN ALSO BE USED AS A MANUAL PLAYER. F.O.R.

£10/15/-

NEW MULTIMETERS—61/- POST EXTRA

METER 0-1mA 1000 OHMS PER VOLT

A.C. RANGES	D.C. RANGES	CURRENT RANGES
0—10v	0—10v	
0—50v	0—50v	0—1MA
0—250v	0—250v	
0—500v	0—500v	0—100MA
0—1000v	0—1000v	0—500MA

PPLIED COMPLETE WITH TEST LEADS. RANGE 0-100,000 OHMS.

BATTERY CHARGER RECTIFIERS

New Selenium Rectifiers, 6 or 12 volt, at 4 amp., 37/6.
Post, N.S.W., 7/6; Interstate, 10/-.
Transformer for above rectifier tapped for 6 or 12 volt, with circuit for charger, 47/6.
Post, N.S.W., 7/6; Interstate, 10/-.

As above, 6 or 12 v. at 2 amp., 27/6.
Post: N.S.W. 3/6, Interstate 4/6.
Transformer for above, 37/6.
Post: N.S.W. 3/6, Interstate 4/6.

NEW. RECORDING TAPE.

Well known make Hi-Fi Recording Tape, P.V.C. base. 5in spools. 00ft. 20/. Post 1/6.

SARLON HI-FI GRILLE FABRIC AT HALF PRICE

Popular colours. 54in wide. 25/ per yard. Post extra.

DUAL CONCENTRIC POTENTIOMETERS

1 meg + 200K + switch.
meg + 50K + switch.
1 meg + 5K.
meg + 10K.
meg + 20K.

6/6 ea

SINGLE CRYSTAL EAR PHONE 7/6

TANDARD INTERMEDIATE FEQUENCY TRANSFORMERS

455Kc. 1¼in square cans. Slug tune. 4/9 post extra.

EXTENSION SPEAKERS

N Rola 9 x 6 speakers in case with volume crol. 75/. Post Interstate 5/6. N.S.W., 4/.

EECTROLYTIC CONDENSERS

New condensers.

8m 525v	2/9
16fd 600V	5/9

Post Extra

NEW CRYSTAL MICROPHONES £2/5/-

TV OR AMPLIFIER POWER TRANSFORMER

240V Pri. Sec. 260 x 260V at 300 MA. Two 6.3V windings at 4.5A and 5V at 6A. 55/.
Post N.S.W. 10/. Interstate 16/.

80mA TRANSFORMER

240v pri., sec. 285 x 285, 6.3v and 5v. fil. windings.

32/6
Post: N.S.W., 5/; Int., 8/6.

NEW POWER TRANSFORMERS

60mA prim.: 240v with 230v tapping, Sec. 285 x 285 with 6.3v filament winding 60mA.
25/- Plus postage, N.S.W. 3/6, Int., 5/3.

NEW MIDGET POWER TRANS.

40mA prim., 250v. Sec. 225 x 225 with 6.3v Fil. Winding. **27/6** Postage: N.S.W., 2/6; Interstate, 4/6.

30mA 240v Prim. 150 x. 150v. Sec. with 6.3 v Fil. Winding. **25/-** Postage: N.S.W., 2/6 Interstate, 3/6.

MICA AND CERAMIC CONDENSERS

Standard Mica Condensers, small current types .00003 and .005, including most wanted values.
10/- per 100. Postage 1/6.

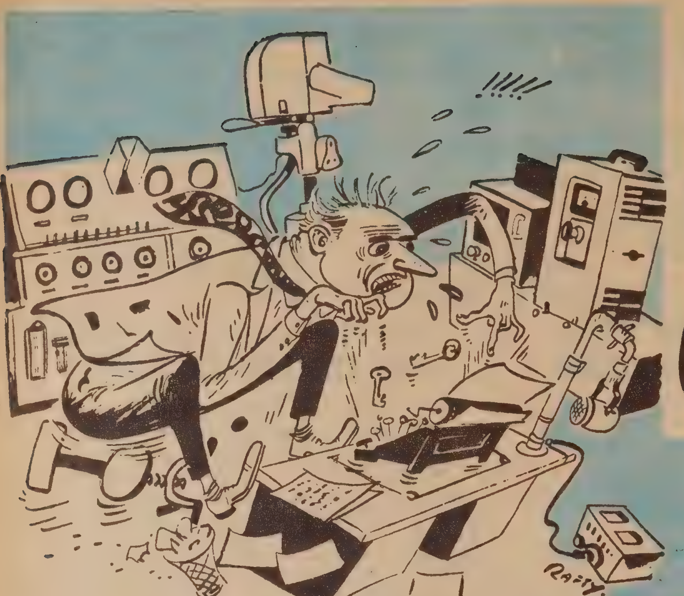
NEW POTENTIOMETERS

with SWITCH STANDARD SPINDLE	WITH SWITCH SHORT SPINDLE	LESS SWITCH STANDARD SPINDLE	LESS SWITCH SHORT SPINDLE	TAB. POTS.
100,000 ohms	100,000 ohms. 500,000 ohms.	100,000 ohms. 500,000 ohms. 5,000 ohms.	50,000 ohms. 100,000 ohms.	25 k. 250 k. 1 meg. 2 meg.
5/6 ea. 50/ doz.	2/6 ea. 24/ doz.	3/6 ea. 33/- doz.	1/9 ea. 16/ doz.	2/- each.

25,000 ohm screwdriver adjustment, 1/9.

NATIONAL RADIO SUPPLIES

32 PARRAMATTA ROAD, STANMORE, N.S.W. Phone LM7398



Let's Buy An Argumen

—ABOUT THOS PHOTOGRAPHS

One of the things which helps keep a person sane, who works on a radio magazine, is the fact that one occasionally finds things to laugh at. Sometimes the laughs are at the expense of other members of the staff; sometimes (let me whisper it) they have to do with readers who are also equally human.

By Neville Williams

ONE of our constant problems, for example, is to devise projects which will best meet the needs of particular reader groups; then, having done so, to anticipate ways in which readers will inevitably want to vary the projects, so as to allow for same in our thinking, if not in the actual article.

Sometimes this leads to arguments and it isn't at all unusual for one staff member to greet another with a Dagwood grin, a just-arrived letter, and the gleeful claim, "I told you so."

However, one reader came up with a request recently which left us all flatfooted.

You may recall our enthusiastic reports on hi-fi stereo headphones, the adapter unit for using them with an existing amplifier and the little amplifier especially for stereo headphones. In producing this latter, we fretted over the problem of getting enough gain from the simple circuit and enough power to operate the phones, without resorting to transformers in each channel.

WORKED WELL

We were pleased and relieved when the final arrangement worked out as it did.

But hardly had the magazine hit the streets when back came a letter, accompanied by the requisite 2/, asking how the amplifier could be adapted for stereo loudspeakers!

While the rest of the staff guffawed, the Technical Editor beat his brows and wept silently in the corner.

But the reactions on that occasion were as nothing to those which greeted another letter recently to hand. By the noise in the general office, one would have thought that a film was being shown featuring Laurel, Hardy, Abbot, Costello, the Marx Bros. and the Keystone Cops all in one glorious romp.

In due course, the cause of it all was laid on the editorial table with shaking fingers pointing to the last paragraph. I quote:

Dear Sir,

There is something I would like to know.

Is it common practice among magazines and newspapers to publish photos of dignitaries, such as editors, etc, which were taken at least a quarter of a century before?

Perhaps no one bothers to change the blocks. Perhaps it is plain flattery on the part of the staff. Perhaps it is vanity on the part of the editor himself. Who knows?

A sample of this was the photo of the late editor, which appeared on the editorial page each month, yet Mr Moyle was a much older man than the picture would lead one to believe.

Now we have Mr Neville Williams' portrait in the editorial each month, depicting him as a man very much younger than I imagine one in his position to be, especially after being accustomed to the caricature we have become used to in "Let's Buy An Argument." Or is it another namesake?

I would like to know if the portrait is a fair likeness of the ec or is it another case of an and block being used? If it is an block, please have the courage replace it with a recent likeness

Personally, I do not care if h an egg-shell blond or an old si fox; just let me have the truth. magazine is quite capable of sto ing on its own merit without kind of vanity.

But let's hope you do not nee change it.

Yours faithfully,
G.O. (Erina, N.S

Well, I must thank G.O. for his le but I doubt that I'll ever quite li down. Staff members seem to fi interminably funny; my wife, who g hear about it, was scarcely restr from rushing up to Erina to take law in her own hands. In that res G.O., you're a very lucky man!

THE LAST PICTURE

Concerning the picture of the John Moyle, it was taken many ago, but neither flattery nor vanit forgetfulness was responsible for i tention over the years. John was a so preoccupied with the job in han the task of having a new picture was inevitably put off till the month, and the next and the next

As for the "Let's Buy An Argu block, the question was never sett the office as to whether the cari represented anybody in particular body. I can assure you, howeve the by-line is quite genuine.

As for the present editorial and despite unsolicited remarks by bers of the staff (and others) it was t more than a fortnight before first blication.

How long it will persist is another tter.

n this television age, when the heart-obs of yesteryear persistently reappear the screen as heart-throbs still, it uld take some courage to admit pubiy to being an egg-shell blond or an silver fox!

ne more thing. Within one day of eiving the letter, I found myself surnded by photographs and the press- request to let readers see what would pen if we did, in fact, trim twenty rs off the age of our present staff. ot wishing to fill a page with pices, in some cases of very young dren, I compromised with the three the right.

ut enough of the tomfoolery!

GUMENT FROM N.Z.

o judge by several letters to hand n New Zealand readers, quite a few ry arguments are in progress follow- the introduction of commercial teleon.

ne reader explains how he enjoyed various programs from the Auckland smitter until the fateful and alleged- ppropriate day arrived when adverents were introduced — April the He has frequently been annoyed , not only by the advertisements selves but by the chapter of acci- s which early accompanied their inon into the program.

ell now, as to the desirability of rtisements or no, this is a question h is normally debated and decided rounds other than technical.

Australia, there is a minority who tely hate advertisements and every- to do with them. The majority t them as the inevitable price of a extensive service, with feelings ng from mere indifference to active ement at the funny ones!

t "accidents" are by no means the gative of New Zealand television. plagued Australian stations in their l stages, often to the amusement of udience and the embarrassment of n personnel. For a while, discussion ast night's boo-boo" was a stan- topic of over morning tea.

at's more, the boo-boos weren't all by the commercial stations!

t don't let's imagine that Australian w Zealand viewers are hardly done

w would you like to see one half eature film, then be forced to watch ys and comedies for the next hour wenty minutes, before you could e second half of the film?

tastic you say?

haps it is, but its true. In case you oubt the statement, let me quote "Radio and TV Digest," London, June 19, 1961.

"REAK OF 80 MINUTES IN ITV S: Independent Television is to a further selection of cinema fea- lms on Saturday evenings, starting onth. But for many they will be by an interval of an hour and 20 s in the middle filled with nor- V entertainment and commercials.

"hind this lengthy break is an at- by ABC Television, the company ned, to keep people looking in all A spokesman of the company "We hope to encourage people to home on Saturday evenings."

Christopher Mayhew, Labour or Woolwich East, said he would protest to the Independent Television Authority. "The normal commercial breaks are bad enough," he said. "This is a further debasement of television standards, influenced by the profit motive. If the film is any good, the break will be maddening to viewers."

So there you have it. Next time there's a break in the tense part of the evening's film, thank your lucky stars that it isn't going to be any bigger than necessary to accommodate announcements on coffee beans, hair oil and toilet paper.

At least you don't have to wait around for an hour and twenty minutes!

But, in passing, and speaking of breaks in programs, may I suggest that all concerned seek diligently to avoid inserting advertisements into dramatic segments of feature films, never made in anticipation of such insertions.

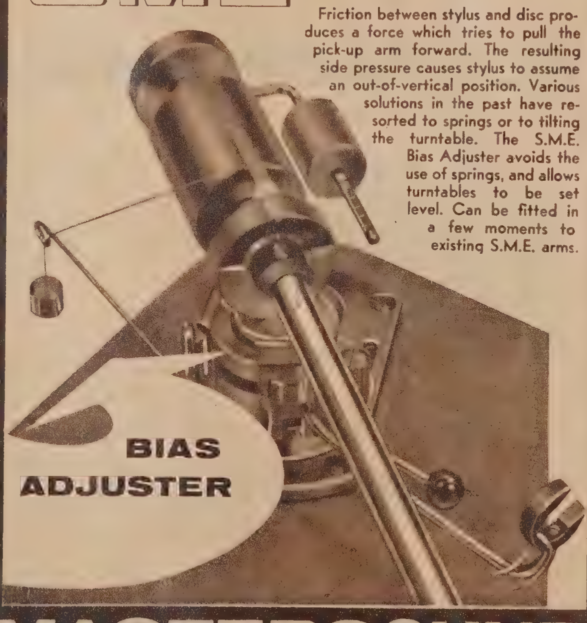
To be sure, such advertisements are noted but in such sheer aggravation that the reaction may be anything but to the goodwill of the product! Think back to the old silent film days when the program was interrupted at regular intervals by those fiendish "End Of Part One" breaks.

However, to proceed, annoyance at the advertisements in New Zealand has sparked off another argument about how to silence the television receiver during the commercials.

STAFF MEMBERS AS G.O. SEES US

Our correspondent on the page opposite would probably find these photographs even less convincing. They were really taken twenty years ago! From left to right: Jamieson Rowe, Keith Jeffcoat and the author.

SME



Friction between stylus and disc produces a force which tries to pull the pick-up arm forward. The resulting side pressure causes stylus to assume an out-of-vertical position. Various solutions in the past have resorted to springs or to tilting the turntable. The S.M.E. Bias Adjuster avoids the use of springs, and allows turntables to be set level. Can be fitted in a few moments to existing S.M.E. arms.

MASTERSOUND

LIDO HOUSE, 400 KENT ST., SYDNEY. 29-2977

TYPE 72 PENCIL MICROPHONE

- Australian made for Australian conditions.
- Robust Dynamic Insert.
- Excellent frequency response.
- Stand or hand operation with quick release from clamp.
- Detachable Cable. Quick Release.
- Pleasing appearance.
- Low cost.
- Ideal for Studio, Interviews, and Nightclub use.

TECHNICAL DETAILS

FREQ. RANGE 50 to 17,000 CPS
OUTPUT—50db Odb-1volt/dyne/cm2
IMPEDANCE 50 ohms
FINISH Grey and Satin Chrome
SIZE: 1½inch Front O.D. to
1⅛inch Rear O.D. by
7½ inches Long.
CONNECTION. Locking 3 pin Cannon
SWIVEL. 5/8 inch 26 T.P.I. to
1⅛ inch slotted clamp.

Manufactured by

ZEPHYR PRODUCTS PTY. LTD.

58 HIGH STREET, GLEN IRIS, S.E.6, VICTORIA

MANUFACTURERS OF RADIO & ELECTRICAL EQUIPMENT & COMPONENTS

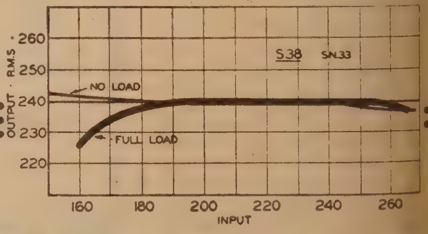
VOLTAGE REGULATION!

...with the TRIMAX

60 V.A. and 250 V.A. VOLTAGE REGULATIONS which are available with flexible lead entries and 3-pin socket or with conduct entries.

TRIMAX

for Transformers
and associated equipment



L M ERICSSON-TRIMAX PTY. LTD.

CNR. WILLIAMS ROAD AND CHARLES STREET, NORTH COBURG, VIC. . . PHONE FL 120 am only piecing the story together various letters and clippings which reached me but it appears that eone started proceedings by suggest- in a letter to a newspaper, that the g " could be taken out of television rtisements by silencing the loudker while they were being shown. was very simple, he explained. You ly got your local radioman to cut of the wires leading from the chassis he loudspeaker, looping into the a piece of lamp flex long enough ach the viewing position. At the end e flex you put a switch. "When dvert appears, press the switch and, ld, the blah, blah stops."

e suggestion didn't go unchallenged ong. Other readers were quick to out that it was a very dicey pro- e simply to interrupt one of the leading to the loudspeaker.

be sure, it would silence the sound if the output transformer happened mounted on the loudspeaker frame, upting one lead would open the circuit of the output valve. Since atter would invariably be a pentode rode, opening the plate would cause creen grid to overheat, distorting ysically or releasing occluded gas. ort, it was a very effective way of g audio output valves!

weakness of this argument ap- d to be that few television receivers ly had the output transformer on udspeaker frame, most being on the s itself, with the secondary leads ded. Interrupting one of these lat- ads left the output plate circuit but did leave the way open to the ation of high peak voltages, which cause arcing within the output ormer, or within the valve or across lve socket.

ooey" said someone else. If the ension supply in the receiver is 250 or some such similar figure, where the extra volts come from?

NE ANALOGY

ing to explain this, and adding a ul "red herring," someone suggest- t the situation was rather analgous at would happen to an engine if ad were suddenly removed with- sting back the throttle.

, but not least, someone really the wires by querying how dan- peak voltages could be built up output transformer was discon-

e aps in the face of this it is not ing that I find a batch of letters ewspaper clippings on the table leas to sort it out—please!

g the arguments in order, it is lefinitely bad practice to open the plate supply to a pentode de valve, while leaving the screen intact. When this happens, elec- hich would normally pass to the ivert to the screen, causing the current and screen dissipation to above the rated limits.

a spiral of relatively fine wire, than a husky metal plate, the n promptly becomes very hot, y glowing a bright orange-red. e circumstances it can readily to produce an internal short in e; alternatively occluded gas may n out, to cause the valve there- be gassy — with its own sub- problems.

open circuiting the plate is a ndesirable procedure, one could however, that it would wreck every valve in every case. Much would depend on the type of valve, the individual valve, and the screen voltage and current under the abnormal conditions.

My advice! Don't use this method in any circumstances.

If practice in New Zealand is similar to that in Australia, the output transformer will generally be found on the receiver chassis, so that opening a speaker lead will not, in fact, open the plate circuit of the output valve. It will, instead, open the circuit to the loudspeaker voice coil, which is the load into which the output valve operates.

Operating a pentode or tetrode valve into an unloaded transformer can, quite definitely produce peak voltages far in excess of the nominal tension supply voltage. These are generated by the build-up and collapse of the magnetic field within the output transformer.

PLATE VOLTAGE

In a quiescent condition, the voltage at the plate of the output valve is equivalent to the supply voltage minus the small amount of drop across the DC resistance of the winding. A magnetic field exists in the output transformer core by reason of the steady plate current.

When a signal is applied to the grid, causing the plate current to increase and decrease in cyclic fashion, the build-up and collapse of the field within the core — also in cyclic fashion — generates an emf which adds to the quiescent plate voltage. Under idealised, properly loaded conditions, the plate voltage swings from nearly zero at peak positive grid swing to nearly double the quiescent figure at peak negative grid swing.

Without loading or other limitation, however, a highly distorted plate voltage waveform may result, producing a plate voltage swing from near zero to much more than twice the quiescent plate voltage. It is this latter peak which can cause an ultimate breakdown. The conditions become even more severe, if aggravated by possible parasitic oscillation in the unloaded output stage.

However, it is fairly common practice, nowadays, to use negative feedback around the output stage which serves to limit considerably the generation of distorted waveforms and high peak voltages. In fact, in amplifiers having a large amount of negative feedback, it makes very little difference to the output voltage whether a load is connected or not!

Alternatively, where no feedback is used, it is fairly common practice to fit a treble cut R/C filter across the transformer primary, to offset the rise of the total output circuit impedance at high frequencies. Such a capacitor will also limit peak voltages under no-load conditions.

Summing up, one might suggest the following:

(1). It should be possible to open the voice coil circuit with impunity provided the audio system uses substantial negative feedback — say 12db or more.

(2). Where the audio system uses only a small amount of feedback or an R/C output filter, opening the voice coil will seldom cause trouble, provided that the volume control is set at the time for only LOW TO MODERATE room volume.

(3). Unless conditions (1) or (2) are

(Continued on Page 79)

Metropolitan
RADIO SUPPLIES
640 KING ST., NEWTOWN
N.S.W. — LA8087

'F' Telephones
Ideal for shop to store communications. Ex army type, far cheaper than normal P.M.G. — no yearly rentals.
£4/9/6.
(5/- Delivery to Rail)

Portable Transmitter
Contains many useful parts including 6ft collapsible aerial.
7/6
(Post 3/6)

Power Transformers
230V PRIMARY
(a) C.T. 35 mA: 6.3 volt. 1.5 amp. 5 volt, 3 amp.
(b) 335 volt C.T. 60 mA. 6.3 volt 3 amp. 5.0 volt 2 amp. 6.3 volt 3amp
(c) 300v C.T. 140 mA. 5.0v 3 amp. 40v 2amp.
(d) 260v C.T. 240 mA. 6.3 volt 2 amp. 5.0 volt 3 amp. 4.0v .2 amp.
35/-
(Post 10/-)

522 Transceiver
100-150mcs. good condition, complete with valves.
£12/10/-
(5/- delivery to rail)

CO-AX CABLE
72ohm. Ideal for working car radios. etc.
1/ per yard.
(Post 1/- any length)

HEAD PHONE CORDS
5/6
(Post 1/-)

CHIPMUNK EAR PHONES
Correct ohmage for light aircraft.
21/- pair.
(Post 2/6)

REDMOND ELECTRIC MOTORS
6v lt. D.C. Motors. Ideal for driving car fans. 35/-.
(Post 4/6).

COIL KITS
Aer—RF—Osc. for Broadcast band. 13-42 metres. 16-50 metres. 40-110 metres.
5/- each
(Post 1/-)

CAR AERIAL
Three section chromed cowl mount type.
57/6
(Post 2/6)

TEST PRODS.
8/6
(Post 1/-)

BUZZERS
High pitched buzzer with an adjusting screw. Works from 1½ volt batteries. 5/.
(Post 1/-)

EX-ARMY BUZZER
With adjustable tone. Suitable for use with morse key set.
5/-
(Post 2/6)

BOOKS

101	Two valve Receiver	2/3
102	40 Germanium Diode circuits	4/6
115	Constructor's Germanium Diode Handbook	3/9
126	The Boys Book on Crystal sets	3/9
131	Guide to Modern Valve bases	3/9
133	Radio Controlled models	7/6
134	F.M. Tuner construction	3/9
140	Television Servicing for beginners	6/9
146	Hi Fi loudspeaker enclosure	7/6
147	Practical tape recording handbook	7/6
149	Practical Stereo handbook	5/3
156	Transistor circuits manual	3/9
159	Realistic Hi Fi	7/6
162	Hi Fi stereo gramophone	7/6
163	Transistor circuits manual	3/9

(Post 1/-)

FERRITE ROD AERIALS
These rods replace normal external aerial coil and thus improve selectivity and sensivity.
17/-
(Post 3/6)

SANWA MULTI-TESTER
An addition to the famous Sanwa family compactly built in Shockproof metal case. This instrument is invaluable in locating household electrical faults AC-DC Volts D. to 250 M/A current scale. Price 79/6.

Miniature Valve Socket
1/6
(Post 6d.)
Crystal Earpiece
10/-
(Post 1/-)
Crystal Insert 15/6
(Post 1/-)

MAIL ORDERS
To 640 King Street, Newtown, and all are treated with greatest care.

TRADE REVIEWS AND RELEASES

NEW TANDBERG TAPE RECORDER

Pictured at the left is the new Tandberg Tape Recorded. Although physically small, this recorder is capable of first class results, the design and engineering techniques employed placing it in the "professional" class. Capable of stereo reproduction as well as mono, it will suit both the hi-fi enthusiast and the recording engineer.

The latest Tandberg Tape Recorder, designated as Series 6, is a three-speed, four-track stereo model featuring four separate amplifiers, two for recording and two for playback. Complete flexibility of operation makes this a very attractive instrument indeed.

SUPPLIED to us for review by Simon Gray Pty. Ltd., 28 Elizabeth St., Melbourne, the recorder gave an excellent account of itself, bearing out all of the manufacturer's claims for its performance. A more detailed, independent test fully substantiated our own observations on its capabilities.

High and low level mixer inputs are provided, in addition to cathode follower outputs. Provision has been made for complete remote operation, if desired, the instrument normally functioning by push-button control.

Tape speeds are 7½in, 3¾ and 1 7/8-in per second, with the added advantage of being able to change speed instantly while either playing or recording.

The frequency response is quoted as 30-20,000 cps at 7½in, 30-15,000 cps at 3¾in and 30-7,000 cps at 1 7/8in. The overall quality of reproduction is such that only the most critical ear, listening under ideal conditions, could tell the difference between a hi-fi microgroove recording and a re-recording on the Tandberg playing at 7½in ips.

Noise level is 55dB below the maximum recording level, being virtually inaudible under normal conditions. At 1⅞in. wow and flutter are quoted as 0.25 per cent, falling to 0.1 per cent at 7½in. The cabinet is of polished teak, which gives a very pleasing finish to this versatile instrument.

AWV TRIODE-PENTODE

Recently introduced by AWV, this new triode-pentode valve, type 6EB8, will be of interest to those engaged in TV receiver design and allied applications.

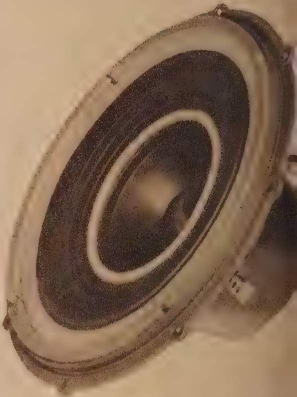
AWV
RADIOT
6EB8

THIS valve is a dual unit, noval-based type containing a high-mu triode and a sharp cut-off pentode in the one envelope.

The pentode unit features high transconductance (12,500 umhos), at the same time having a plate dissipation rating of 5 watts. This makes it especially suited to video amplifier operation. The triode unit has an amplification factor of 100 and may be used for a variety of purposes. Separate cathode pins are provided, together with shielding between the two sections.

8in. BI-PLEX CONE SPEAKER

Readers requiring a small, high quality loudspeaker will be interested in the Mirror Phone R-21-S, currently being marketed by Messrs Brown and Watson Electronics Pty. Ltd., of 281 Latrobe St., Melbourne.



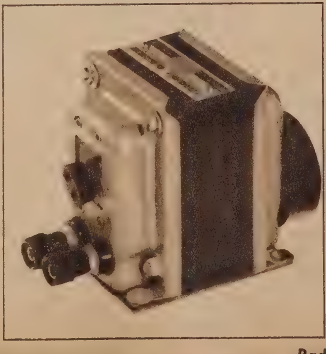
OF Japanese manufacture, the speal features mechanical frequency cro over system, with separate sections the cone joined by foam plastic.

Foam plastic outer surround ensu a low fundamental cone resona (quoted as 45 cps) with good absorpt of energy at the cone edge. On listen test, with an audio generator, freque response appeared to be notably smo over the whole audible range.

Flux density is quoted as 12,000 ga total flux as 65,000 lines, maxim power input 11 watts and voice coil pedance 8 ohms. Retail price is £9/

TRANSFORMERS FOR L.W. IRONS

Ferguson Transformers Pty. Ltd. announce the introduction of two new tranformers especially designed to suit the Mico or other simila lightweight soldering irons.



THE unit illustrated (type TS.12 has a 240-volt primary, secon tapped at 10, 11 and 12 volts at amps and is designed for continuous at 40 watts.

The second unit which is of the appearance as the one illustrated, is signated as type TS.8/30, has a sec ary tapped at 6, 7 and 8 volts at amps and has a continuous ratin 30 watts. The voltage and current ings of this transformer enable duty work to be undertaken with tl volt 20-watt Mico iron while the tapping provides for normal or sta service.

Retail price for the units, incl sales-tax, is £4/8/3 for the TS.8/3 £4/11/2 for TS.12/40. Furthe quiries should be directed to Fer Transformers Pty. Ltd., of 411 Vi Avenue, Chatswood, N.S.W.

TELEVISION ANALYST FROM AWA

Currently available on the local market through AWA Engineering Products Division is this Television Analyst, model 1076, one of the latest additions to the well known B & K range of test instruments. An extremely useful and versatile instrument, it makes possible very rapid fault finding in TV receivers by the time-honoured method of circuit substitution.

HE Analyst contains a built-in flying spot scanner and provides a t pattern which may be fed into any ge in a receiver. By suitably narrow- down the points of injection, it is ssible to locate very rapidly the par- ular stage in which the trouble is curring.

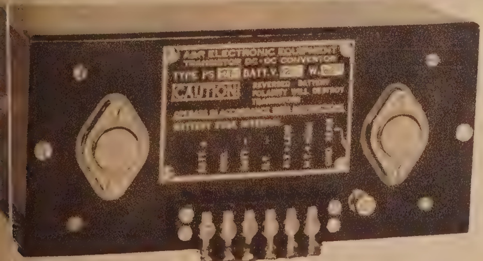
omplete video signals are available all Australian channels in addition an IF signal. Modulation of these nals is accomplished by sliding a ck-and-white transparency in front of scanner tube, the modulation level ng adjustable. Alternatively, the video nal itself is available for feeding into video stages and is complete with c. pulses, either positive or negative- ng, which are adjustable in ampli- e.

5.5 Mc. carrier is available, fre- ncy modulated with 25 Kcs deviation by a 400 cycle tone or any external audio source if desired. High level AGC keying pulses are also available from the front panel for checking keyed AGC circuitry.

Both vertical and horizontal drive voltages are available for checking the sweep output transformers. Alternatively, drive from the internal vertical and horizontal oscillators may be applied to the grid of the appropriate output stage in the receiver. In addition, sensitive tests may be applied to the deflection coils and also tests made for shorted turns in the EHT transformer.

Space does not permit a full resume of all the features involved, however, and further inquiries should be addressed to the distributors, Box 2516, G.P.O., Sydney. The list price is £170 plus S.T., f.o.b./f.o.r. from Australian capital cities.

A. & R. DC-DC INVERTER SUPPLY



ECENTLY released by A. and R. Electronic Equipment is this new DC converter type P.S.21. Designed use on 12 volts input, the unit has aximum output of 60 watts at up 00 volts. The primary current under itions of maximum output is 5.9 s.

varying the connections on an in- l tagstrip, output may be had at r 400 and 200 or 300 and 150 volts simultaneously with a maximum total loading of 150 milliamps. An internal fuse is provided as protection against breakdowns within the unit.

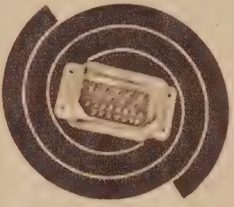
Filter components are provided only on the higher voltage ranges, but there is some room inside the unit to fit components for filtering the low voltage ranges if required.

The unit is housed in a steel case measuring 8 inches by 3¼ inches square and has three sets of mounting holes to facilitate mounting in any position.

Further inquiries should be directed to the manufacturers, A. and R. Electronic Equipment Co. Pty. Ltd., of 378 St. Kilda Road, Melbourne, Victoria.

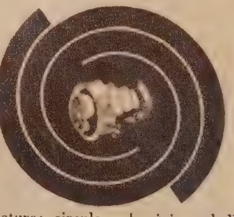
CANNON PLUGS
Rack/Panel/Chassis & Miniature

Standard DPD — strong aluminium shell for unit-plug-in applications. Wide range of contact voltage and amperages, including coaxials.



Miniature rack & panel type: shell protected 13 available insert arrangements: 5-amp, 10-amp and miniature coaxials: split shell.

D Sub-miniature rack/panel type: steel shell protected: all 5-amps. 9 to 50 contacts; flash. 1700v dc: junction shells, locking means, floating mounting holes: also hermetic seals.

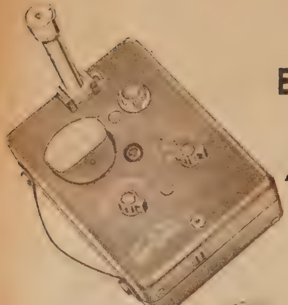


K-Miniature; circular, aluminium shell protected; 3, 10, 20, 30, 38 contact arrangements; voltage up to 4000v ac. Also hermetic seals.

For information, write to Dept. RTH3,
CANNON PLUGS (AUST.) PTY. LTD.,
Cnr. Matthews Ave. & Hood St.,
Airport West, W.6, Melb., Victoria.

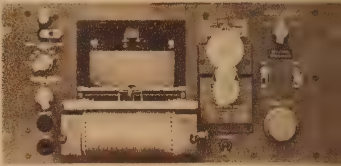
CANNON ELECTRIC
SINCE 1915

CANNON ELECTRIC



A Sampling of ELECTRONIC INSTRUMENTATION by GENERAL RADIO COMPANY, U.S.A.

Available from WARBURTON FRANKI



1551—B SOUND-LEVEL METER

. . . Meets all ASA specifications for sound-level meters. Measuring range is from 24 to 150 db above 0.0002 μ bar with better than 1-db accuracy. Output for analysers and recorders.

1521—A GRAPHIC LEVEL RECORDER

. . . Plots linearly in db on 4-inch chart paper the rms level of a-c voltages from 20c to 200 kc. Couples to oscillators for automatic frequency-response recordings. Range is 40 db full scale with plug-in potentiometer supplied (20-db, 80-db, and 0-0.8 volt d-c potentiometers also available). Recorder sensitivity is 1 mv (0-db point). Writing speed is 20 in/sec. (200 db/sec) with 40-db pot.

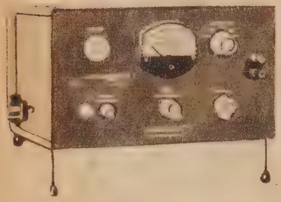
1230—A D-C AMPLIFIER AND ELECTROMETER

. . . A milli-voltmeter, micro microammeter mega-megohmmeter, and d-c amplifier in one package. Useful for a wide variety of high-impedance d-c applications including measurements of pH indications, ionization currents, and bio-electric phenomena. Measures voltages from 0.5 mv to 10v, dc; currents from 0.005μμa to 1ma, dc; and resistances from 0.3 megohms to 500 mega-megohms. It can also be used as a d-c amplifier (current gain of over 16 x 10)to drive recorders and oscilloscopes.

1531—A STROBOTAC—STROBOSCOPIC TACHOMETER

. . Intense white-light electronic stroboscope useful for speed measurements analyzing repetitive actions in apparent slow motion, photic stimulation, and flicker-fusion studies. Flashing range is 110 to 25,000 flashes per minute. Flash duration is 1 to 3 microseconds. Can be triggered externally.

1390—B RANDOM-NOISE GENERATOR



. . . A source of wide-band noise approximating the statistical amplitude distribution of speech, music and sounds that occur naturally. Useful for audiometric and pyschoacoustic testing as well as for simulating various masking effects. Three frequency ranges: 20c to 20 kc; 20c to 500 kc; 20c to 5Mc (3db down at 5c). Built-in attenuator.

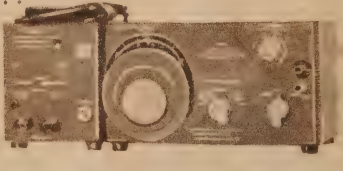
1554—A SOUND AND VIBRATION ANALYZER

. . . For the measurement of amplitude and frequency distribution of complex waveforms over the frequency range from 2.5c to 25 kc. Bandwidths: "Narrow" . . . 8% of centre frequency at 3-db points; "One-third Octave" . . . 23% of centre frequency; and "All-Pass" . . . a flat characteristic from 2.5c to 25 kc. Couples to the 1521—A Recorder for automatic spectrum analysis.

One of a wide line of frequency sources . . .

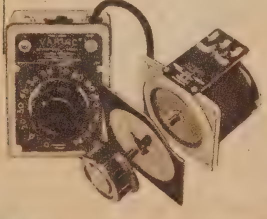
1210—C UNIT R-C OSCILLATOR

. . . A general-purpose sine-and-square-wave oscillator with a 20c to 500kc frequency range. Can be converted to sweep-frequency operation.



546—C MICROVOLTER (Not show

. . . Used with an oscillator to produ accurately known small a-c voltag . . . can be used to measure ot small voltages by substitution metho Voltage range, 0.5 μv to 1.0v open c cuit. Basic accuracy is ±3% to kc; useful up to 100 kc.



CONTINUOUSLY ADJUSTABLE AUTOTRANSFORMERS . . . VARIAC

For the efficient control of a-c voltage from 0 to 17% above line voltage. Ideal for cont of light, heat, and processes. Available in ratings from 2 to 50 amperes.

FOR FURTHER INFORMATION CONTACT INSTRUMENT DIVISION

WARBURTON FRANKI

ADELAIDE: 204 Flinders Street. W 17
BRISBANE: 233 Elizabeth Street. 31 2
MELBOURNE: 359 Lonsdale Street. 67 8
SYDNEY: 307 Kent Street. Phone. 29 11
PERTH: Tough Instrument Service Co.
993 Hay Street. BA 76
NEWCASTLE: 844 Hunter Street. MA 40
WOLLONGONG: 80 Keira Street. B 544

WF!P

TECHNICAL BOOK REVIEW

RINCIPLES OF TRANSISTORS, by M. G. Scroggie, B.Sc., M.I.E.E. Published by Iliffe Books Ltd., London. Hard cover, 5½in x 8½in, 156 pages. Photographs, circuits and diagrams. Also published in America as FUNDAMENTALS OF SEMICONDUCTORS, book number 92 in the Gernsback Library Series. This version is soft covered, but otherwise identical to the English version.

The author of this little book is well own by his writings in the magazine Vireless World" under the nom-deume of "Cathode Ray." As readers of at magazine will be aware, he has the ppy knack of being able to explain most any technical concept in clear, sy-to-follow language.

This book therefore comes as a welme addition to the literature on seminductors. Using his typical chatty le and carefully-chosen analogies, the thor explains the subject in a way ich should clear up quite a lot of consion.

A glance at the chapter headings will e a fair indication as to the manner which the material is treated:

"A WIDE-OPEN PROSPECT."
"BEGINNING WITH THE ATOM."
"ENERGY AND MATTER."
"A TYPICAL SEMICONDUCTOR."
"JUNCTIONS."
"DIODES AND RECTIFIERS."
"TRANSISTORS."
"PHOTOCELLS."
"OTHER SEMICONDUCTOR DEVICES."

Students, technicians and hobbyists shing to become familiar with semiductors should find the book ideal, as covers all the necessary theory and ysics in a simple yet concise manner. ly the actual theory required is given, wever, which prevents the book from oming pedantic and thus defeating its n purpose.

inal summing up: A concise, easy-tod little volume on the fundamentals semiconductors. It should find a dy place on the workshop bookshelf. ur copies were from the two respec- publishers direct, but both should available locally in due course.—J.).

★ ★ ★

ANSFORMERS, volume 37 in the Electronic Technology Series, edited by Alexander Schure, Ph.D., Ed.D. Soft cover, 88 pages 8½ x 5½ inches; editorial material extensively illustrated by graphs and circuit diagrams. Published by John F. Rider Inc., of New York.

his is one of an economically priced s of books, each of which is devoted e explanation of the basic concepts principles of individual phases of ronic technology.

lume 37 discusses the transformer t is used in electronic equipment. subject is examined in a highly tical manner, with numerous ematical examples and, in this way, eader gains a theoretical as well as ctical view of the subject.

mmencing with a discussion of the etic principles underlying the operation of the transformer, the book progresses to transformer design and construction. It discusses such things as coil currents, flux density, core losses, leakage inductance, and distributed capacitance. Current as well as voltage waveforms are also analysed.

Power transformers are studied in detail, from the simple colour coding of leads, to the relationship of power transformers to rectifier filter systems.

Audio transformers, too, are covered, with emphasis on such important topics as impedance ratios, broadband audio transformers and transistor transformers. In the area of high frequency transformers the text treats tuned and untuned primary and secondary windings in different combinations and discusses in detail special devices such as saturable reactors, voltage regulating transformers, video transformers, pulse-transformers, and balancing transformers (baluns).

Throughout the book, transformer theory is presented with simple mathematical treatment, which permits sufficiently extensive analysis and allows the interested technician or student to develop full comprehension. Detailed descriptions of a small number of selected major topics are presented and, through presentation of practical situations, equipment and problems, the reader is afforded an opportunity to apply the principles he has learned.

Our copy came direct from the publisher, John F. Rider Inc., but copies should be available on the local market in due course. Price is as yet unknown.—K.W.J.

LET'S BUY AN ARGUMENT

(Continued from Page 75)

known to apply, the voice coil circuit should not be opened.

No one in the correspondence to date seems to have mentioned shorting the voice coil or the primary winding. In most cases, and provided it is not done with a high volume setting, this should not cause any complications. However, with high volume settings and with high-slope valves used under maximum conditions, it can cause a sharp rise in plate dissipation.

In short, it is possible to silence the speaker by opening or shorting the secondary winding or by shorting (not opening) the primary — in many cases without ill effects. However, there are enough risks and exceptions to render it an unwise procedure for non-technical people to attempt.

The "purist" approach, which again involves someone with technical know-how, would be to silence the audio system ahead of the output circuit or to add more complex circuitry to the secondary winding which would substitute a resistive load in place of the loudspeaker when this is to be rendered inoperative.

FM BROADCASTING

In conclusion, I reprint below a letter, typical of the protests received at the closure of the FM stations.

Dear Sir,

I heartily endorse the remarks in your recent editorials on frequency modulation. The failure of our Australian broadcasting to keep pace with that of other countries is a disappointment to Australians (or at least to those of us who are aware of the comparison.)

The Government is deserving of censure in this matter. When the Postmaster-General stated in Parliament that there was no likelihood of any use being made of the VHF band for broadcasting for some considerable time, he revealed the sterile attitude of the various statutory bodies in whose hands lies the future of our radio.

The PMG Department, the Control Board, and the ABC are reasonably expected to provide radio licence holders with the best service that modern technology can offer but their handling of the radio side of their duties, during the past 10 years, shows how they have neglected their responsibilities in this regard. One might infer that they consider their duties are to provide as low a standard as the public will accept.

It is apparent that these bodies, as they are at present constituted, are so lacking in enthusiasm that there is not much prospect for future development of our national radio. Considering the proportion of the licence fees devoted to maintaining these bodies (as revealed in the Control Board's reports), one wonders whether the cost of the administration is out of proportion to the amount spent on the actual services.

Perhaps, if our national broadcasting were handled completely (from production to transmission) by an independent corporation, similar to the BBC, we might get better results and, by comparison with other countries it certainly looks like it.

Although limiting the FM broadcast band to 92-94 Mc/s. is to be deplored as a departure from the Geneva Convention, it would at least be a reasonable compromise. It seems that departure from the international VHF band will mean a considerable loss of economy in production and maintenance of domestic receivers, as well as losing any export market.

Exciting possibilities for stereo sound in association with TV and ultimately of stereo multiplex broadcasting should not be overlooked.

I urge R, TV & H to continue as vigorous a campaign as possible for the establishment of FM broadcasting in the international VHF band so that Australia will not fall to the bottom of the list when it comes to radio. If enough readers write to their M.P.'s requesting that their letters be presented to Parliament as a petition, some further attention will certainly be given to the matter before the coming elections.—Yours sincerely, A. J. McAllister (Wollstonecraft NSW.)

OFF THE RECORD — NEWS & REVIEWS

NEW TRANSISTOR PICKUP PREAMP.

A simple piece of audio gear, submitted recently for review and test, has modified considerably my ideas of transistor preamplifiers for magnetic pickups. What is no less important, it would appear greatly to simplify the present problems of changing from a crystal to a magnetic pickup.

By Neville Williams

TAKING first things first, the idea of using transistors for gramo preamplifiers is not by any means new.

When transistors first became available, with their inherent challenge to "transistorise" anything and everything, preamplifiers and control units received their share of attention.

Not all the circuits devised were successful, partly because of the unfamiliar circuit techniques involved, partly from limited overall gain available; above all loomed the early transistor bugbear of high noise level.

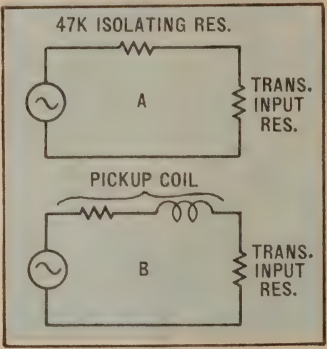
So, while experementers fiddled, the vast majority of audio enthusiasts went on building, buying and using conventional valve preamplifiers.

However, while in Melbourne recently, I was shown a small printed-circuit device by Messrs G. R. D. Instruments Pty. Ltd. and manufactured, in the first instance, I believe, by the same people who make the Labcraft 605 turntable.

The basic idea is quite ingenious. In the simplest case, the turntable can be equipped with a crystal pickup, feeding directly to the input terminals of an amplifier designed only for crystal pickup or similar input.

If, at a later date, it is desired to change to a magnetic pickup, the signal from it is diverted to a small transistor peramplifier unit, assembled on a printed board and attached to the underside of the playing deck. This amplifies the much smaller signal by the requisite amount, while also effecting the necessary bass and treble compensation, so that the resultant can be fed, in turn, to the "Crystal Pickup" terminals of the existing amplifier.

Power for the transistor amplifier is derived from a 14-volt AC secondary winding on the 605 motor itself. This voltage is rectified and filtered in the preamplifier to provide the modest few volts and milliamps of DC necessary for the purpose. The preamplifier thus switches off and on with the motor but, since there is no heating time, its operation is virtually instantaneous.



Two test set-ups for the transistor preamplifier, one involving a 47K series isolating resistor, the other with the resistor replaced by a discarded magnetic pickup cartridge.

In fact, unless on looks up undern the deck to see the little flat pri circuit board, which carries the comp preamplifier unit, one is faced with puzzling spectacle of two shielded w apparently coming from a low ou magnetic pickup, driving a crystal p up amplifier to full output!

With such a facility, record enthus no longer need find themselves "trap by the differing requirements of cr and magnetic pickups. Having bo a crystal pickup—and amplifier ec ment having inadequate gain and c pensation for anything else—a sup mentary transistor preamplifier bridge the gap.

So much for the thought. Wha the actual performance?

To answer this question, Me G. R. D. Instruments invited m listen to a combination of a B & Stereodyne pickup and a transistor amplifier unit feeding into the "Cr Pickup" terminals of an ordinary st amplifier.

Output, quality, balance, etc., sou completely normal.

QUIET

What really impressed me was the that, with the pickup simply lifted the record, and the gain control se fairly loud room volume, there was the faintest trace of hiss, hum or m phony, with an ear held right in f of the speaker cone.

This is a good deal more than could say of the usual valve prear fier. But what of the old "hiss" bear? Here was a transistor preamp with all the other characteristics would desire but with virtually no

However, I reserved final judgı until I had the opportunity of tr a similar unit with gear which I k personally and which could hardly sify impressions with a combinatio fortuitous circumstances. The op tunity came a couple of weeks ago, v I combined a Shure cartridge—havin low output as any I know—a sir transistor preamplifier from G. Instruments and a Playmaster amp with ordinary Crystal Control Unit

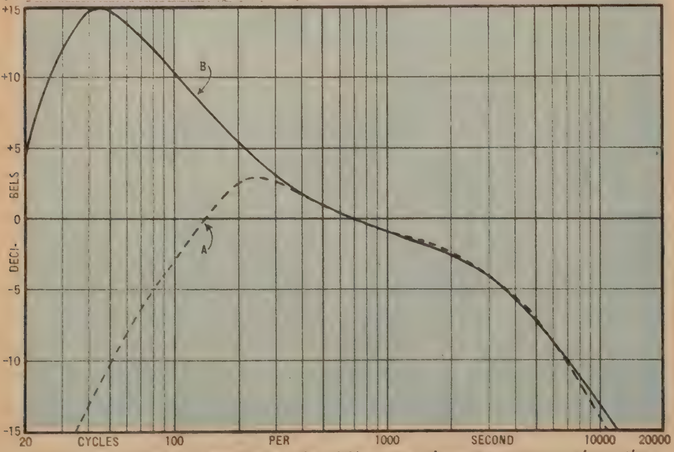
The result? Ample gain, no m phony, reduced sensitivity to mains pulses, very faint hiss at maximum ume control setting and the faintest due, apparently, to a minor earth effect.

Without having toiled through th sign of such a unit, I can't say just the problems might have been or critical the margins involved. I'm even sure whether the transistors are tine types, as marked, or hand-p samples.

One thing is certain: Here's a which works extremely well unde intended conditions and which auto cally demands closer examination c whole proposition of transistor amplifiers.

Technically, the design of the raises an aspect of pickup compen to which, I wager, very few desi have yet given any consideration.

Thinking to analyse operation o unit, we set it up with a VTVM to



Drawn coincident to emphasise the difference, these two curves show the vital difference in bass characteristic produced by the interaction of the amplifier's input resistance and the reactance of the pickup cartridge.

re the output, with input from a low
npedance audio generator feeding
rough a 47K, isolating resistor. This
tter was included, as a matter of
urse, on the assumption that some
ch component would be necessary to
ovide the loading usually specified for
pical magnetic cartridges.

We were quite shocked, however, to
d that the resulting curve (A) exhi-
ted nothing like the anticipated RIAA
aracteristic, being a lumpy looking
ing with a prominence in the region
250cps.

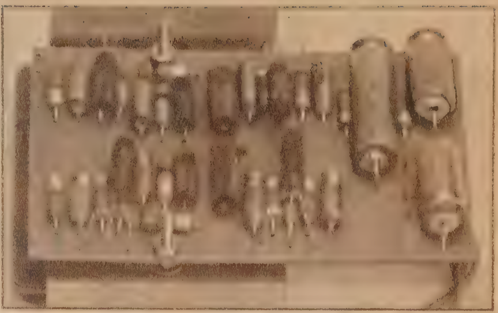
Closer examination of the circuit
owed constants which suggested that
ch a curve shape was not only inevi-
ble but quite intentional. Why?

Then we noticed that the specifications
d not provide for an isolating resistor:
e pickup was to look directly into the
latively low input impedance of the
st transistor. A little thought on the
tter provided the essential clue.

If an equivalent circuit is drawn for
h a condition, one can consider it as
basic generator, feeding into a very
v resistance "load" (the transistor in-
t resistance) through a series inductor
l resistor, representing the inductance
l resistance of the pickup's own in-
nal coil.

t is evident that these form a volt-
divider system containing inductance
l, at low frequencies, two effects will
evident:

) The proportion of pickup signal
tage and current available at the
nsistor base must tend to increase and
b) The source impedance, as seen by
transistor, must decrease, thus modi-
g the effect of preamplifier feedback
s coming back to the input base cir-
.



This four-transistor preamplifier attaches to the underside of the Labcraft 605 turntable, draws its power from a 14-volt AC winding and boosts the output from a typical stereo cartridge sufficiently to feed into "Crystal Pickup" terminals.

☆

With this thought in mind, we simply replaced the isolating resistor with an old "medium impedance" magnetic pickup head and drew a new curve. What emerged (B) is much more readily recognisable as a magnetic pickup compensation curve.

Subsequent checks with an active pickup operating from a stereo frequency test record confirmed that a curve of this general shape was, in fact, realised.

In short, practically all of the required bass boost is dependant on the interaction of the pickup's own internal reactance and the input characteristic of the transistor preamplifier.

What is no less important, the fact that no series input resistor is employed means that the total output from the cartridge is applied to the transistor input circuit—a fact which must assist materially the signal/noise ratio.

Of course, certain objections must immediately suggest themselves.

For example, if the compensation is to depend on the interaction of the pickup's own reactance and the transistor input resistance, then the latter may have to be "tailored" for each type of cartridge, with the further possibility then that not all will be amenable to such treatment.

This objection is a perfectly valid one but, without having had the opportunity of discovering the "spread" in the reactance of individual pickups, I have no idea as to what the order of the difficulty might be. I only know that the original preamplifier was designed for a B & O Stereodyne, that it produced a likely looking curve (A) under test with a nondescript LP head, and that it also worked well with a Shure cartridge.

It may be that such an approach will be close enough for most cartridges intended to work into the usual 47K to 100K load.

Then, too, there is the question of

(Continued on Page 85)

NEW NEW NEW NEW NEW NEW NEW NEW

..there's NO question! here is your best buy...

THE J.H. MONO/STEREO TRANSCRIPTION TONE ARM

Here, at last, is an Australian-made highest quality precision pickup arm, yet so reasonably priced that everybody can afford it. Still, it will and must satisfy the most fastidious no-compromise enthusiast, who places perfection above everything. Although in the "budget" price range, this truly superb instrument compares more than favourably with imports from overseas selling up to well over £40

- Wooden body completely eliminating all resonances.
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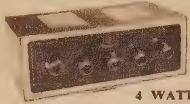

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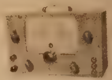

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12v.	1200v.	200mA		£6 10 0
24v.	250v.	100mA.	New	£2 0 0
12v.	235v.	50mA		£2 15 0
12v.	350v.	50mA		£2 15 0
24v.	540v.	200mA	New	£2 15 0
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TRS133	1	93 C.T.	3.0
TRS168	1	84 C.T.	3.5
TRS120	1.5	20 S.E.	3.5
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(Continued from Page 81)

ow individual pickups will react to a ad of a few hundred ohms.

In terms of volts, as seen at a valve id, such a load would probably spell saster to the frequency response. But e are not concerned here with volts a valve grid; it is a matter of current a transistor base. Further, the resulting frequency response is being put to ecial and very good use.

As to the effect on distortion, I have special apprehension. While few ckups rely very heavily on electrical mping, I doubt that the mechanics of the system will ever suffer from too much of it.

So, curiously enough, the very input resistance of transistors, which makes it so hard for the ubiqitous crystal pickup, looks like fitting right into the picture for magnetics.

And having said this, it is inevitable that one should go on to apply the same thinking to tape recorder playback heads.

That, I feel, should be enough to chew over this month. Having said as much, let's get on with some record reviews.

A Review of Sacred Records

NNACLES OF PRAISE, Bill Pearce and Dick Anthony with the Concert Orchestra of London, arranged and conducted by Paul Mickelson. Stereo, Word (Gospel Film Ministry) WST-8015-LP.

Apart from being talented musicians, ll known in the U.S.A. for their reds and broadcasts, Bill Pearce and k Anthony have developed a notable nding of their voices, as vocal duets.

acked here by the Concert Orchestra London, and enlivened by a degree reverberation, the sound off the disc ften full and rich and a far cry from rather bare sound that was common o many religious records a few years k.

n fact, I would say that the record- engineers have overshot the mark at times, tending to wash out the ndid voices with too much orchestra.

he titles are: "Saved, Saved," "To Do Father's Will," "Deep Down In My rt," "Ivory Palaces," "How Great u Art," "There's A New Song In My rt," "Only Jesus," "Sweeter As The rs Go By," "Jesus Led Me All The ," "He Whispered Peace Be Still," "Oh Say But I'm Glad."

vailable in either mono or stereo, disc comes in an original American e.

ough most will find the record oughly enjoyable, critical listeners note places where the controls have backed off to contain sound level s, not always with complete success. wer average level and less monitor- would have produced better results.

* * *

PEL GEMS, The Gospel Harmoneers. Recording Supervised By William Flynn. Mono, W. and G. WG-E-1165.

e Gospel Harmoneers are four g Australians currently singing in al meetings in Victoria.

this 7-inch 45 r.p.m. disc, they pre- "Just A Little Talk With Jesus," "I Believe," "Worthy, Worthy Is The ," and "I Need The Prayers."

ough the presentation is pleasant he voices well blended, the quartet ittle, as yet, to distinguish it from s I have heard. Robbed of the impact, a group like this must re- it with a distinctive style of sing- nd accompaniment. I think they the potential.

* * *

ANGELES TABERNACLE (Salation Army) Band, Conducted by ay Ogg. Mono, GEM-24. (Also vailable in stereo).

a Salvation Army Band, the Los es Tabernacle ensemble is good— doubt that their performance justifies the string of superlatives in the cover notes. I did not notice the music raising any "goose pimples," which allegedly it should have done.

Nor can I rate the technical qualities of the disc as anything out of the ordinary. In fact, those with well-baffled speakers will notice a pronounced tape hum in the background.

The tiles: "The Pioneers," "The Saviour's Name," "Robin Adair," "Rock Of Ages," "Wisbech Citadel," "My All Is On The Altar," "In The Firing Line," "Love Divine," "Victory," "The Reason," "Montondo" and "Marshall."

* * *

HEAVEN CAN BE YOURS, Sermon and Songs by Merv. Rosell. Mono Word (Gospel Film Ministry) W-3127-LP.

An unusual disc, this one features a sermon about Heaven by Merv. Rosell on one side, and well known hymns on the same theme on the other. Merv. Rosell takes the lead with saxophone, against strings and organ.

With the emphasis always on melody, the hyms are "We Shall See His Lovely Face," "Over The Sunset Mountains," "Beyond The Sunset," "Sweet Bye and Bye," "My Home Sweet Home," "The Pearly White City," and "Now I Belong To Jesus."

Smooth and well recorded, this is good background music for religious gatherings.

The sermon, well delivered, is typical gospel material, as used by Merv. Rosell during revival meetings and broadcasts.

Technically the recording is good, except for a few surface crackles.

IN VARIED MOOD

ROBESON, with Chorus and Orchestra and Harriet Wingreen, piano. Mono, Vanguard VRS-9037.

Just when the numbers on this album were recorded is not revealed on the jacket but they would appear to date about 1958—with Robeson in his 61st year and the science of recording well advanced. Whatever the details, you hear a Robeson who sounds a trifle restrained in places, but you also hear, to modern fidelity standards, a voice that is nothing short of a tradition.

The titles are the ones which are most commonly associated with the great Negro singer: "Water Boy," "Shenandoah," "Deep River," "John Brown's Body," "Jerusalem," "Londonderry Air," "Sometimes I Feel Like A Motherless Child," "Get On Board Little Children," "The House I Live In," "Loch Lomond," "Drink To Me Only," "Joshua Fit The Battle," and "All Through The Night."

To sum up—well worth adding to your collection.

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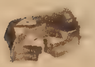

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NO, NANETTE (Vincent Youmans), NAUGHTY MARIETTA (Young and Herbert). Stephanie Voss, Peter Regan, June Marlow, David Croft and Chorus, conducted by Bobby Richards, Produced by Cyril Ornadel, Mono, World Light Music Club. LM-7020.

nooth, melodious, yet always spirited, hard to fault this presentation of s and muisc from two well known vs.

nd it's equally hard to fault the disc he technical sense. Balance, pree and quality are of the highest r, unmarred by the slightest trace of ace noise.

ecommended — especially at the iomy club price.

★ ★ ★

ISTLE A HAPPY TUNE, Fred Lowery, with Orchestra and Chorus. Mono. FL-30058.

hatever else Fred Lowery may or not be able to do, he can certainly stle. And this isn't the kind of whist- which the average man practises in bathroom. With the qualities, at s, of an actual instrument, Lowery's stling ranges from the sentimental nmy," through the bird mimicry of cking Bird Hill' to the oral gymics of the "William Tell Overture."

f course, having available as accomment an organ, orchestra and chorus help! But let's not detract from ery's contribution to a novel and ly tuneful disc.

e quality? Excellent!

★ ★ ★

CING AND DREAMING. Volume 2, Jay Norman Quintet. Mono, Concert-Disc. CDL 30016.

is disc was reviewed in the January issue when, as I remember it, Con-Disc was still exclusively a stereo

ose with mono equipment only now the chance to enjoy this pleasant ction of a dozen listenable — and eable — tunes, including such titles The Breeze and I," "The Way You Tonight," "It Had To Be You," "Amor." Piano, vibes and percussion eatured.

with the stereo version, the quality ghout is excellent and the noise nil.

★ ★ ★

"NEW" OLD REFRAIN. Dick Kesner and His Magic Stradivarius, laying the Music of Fritz Kriesler and Others. Stereo, Coral RL757360.

e technique of Dick Kesner, the l of his much vaunted violin and the ers selected, all conspire to type this l as a thoroughly sentimental inter- If the idea appeals to you, as it o many, I can recommend the disc s technical qualities.

it you get "The Old Refrain," "I You Truly," "Liebesfreud," "Jus aryin' For You," "Ah Sweet Mys- f Life," "Liebeslied," "Stars In My " "Songs My Mother Taught Me," and," "Mighty Like A Rose," "Cap- iennois" and "Oh Perfect Day."

the way, if you're an 8mm movie ond of rivers, lakes and trees, this make good background music for next showing.

DANCE TO THE SOUNDS EVERYONE KNOWS: Wayne King and His Orchestra. Stereo. Festival SFL 930056.

Good songs may be familiar but they never lose their appeal—especially when they can be played in dance tempo by a good dance orchestra. At least, this is what Wayne King sets out to demonstrate and, I would say, with a good deal of success.

To prove his point he presents "My Foolish Heart," "The One Rose," "Honeysuckle Rose," "Theme From Medic," "Dream A Little Dream," "Too-Ra-Loo-Loo-Ral," "Begin The Beguine," "When I Fall In Love," "Peg O' My Heart," "The Waltz Of Love," "It Had To Be You," and "The World Is Waiting For The Sunrise."

Technically this stereo version is excellent, clean throughout and with a quiet surface.

★ ★ ★

EXCITING HONG KONG. Composed and Conducted by Lionel Newman. Monaural, Ampar ML-30090.

When orientals are pursuing their mysterious activities on the television screen, it is appropriate that they should be provided with background music of suitably oriental style. It's not quite so apparent why one would desire such music in the home when the nearest oriental is in a cafe half a mile away!

But having assumed that you are a devotee of the TV series "Hong Kong," Ampar make available some of the themes, ranging in style from purely oriental to purely western.

The numbers all have titles, the recording quality is good — but don't blame me if you go mad trying to invent visuals to fit the audio!

★ ★ ★

DON JOHNSON. Volume 3. King of Organ With a Beat. Stereo, W. and W. WG-BS-1100. (Also available in mono.)

For the sake of the record, this is less of an organ recital than it is a rhythm presentation built around a Hammond Organ. Backing the organ are vibes and percussion, piano, accordion, drums, guitar — banjo and bass.

Let's not disguise the fact, however, that Don Johnson is very adept at making all the noises for which Hammond organs are variously esteemed and despised — including, at times, loads of reverberation. Nor are the other instrumentalists any the less adept.

Fortunately the recording itself stands up pretty well to the rhythmic pounding and I had no complaints on this score.

Among the dozen titles are: "Sweet Georgia Brown," "Tea For Two," "Jalousie," "The Breeze And I," and "Happy Organ."

★ ★ ★

GERSHWIN SPECTACULAR, The Cliff Adams Singers, The Mike Sammes Singers, Orchestra Conducted by Bobby Richards, Produced by Cyril Ornadel, Mono, World Light Music Club, LM-7019.

Orchestra and Singers present a dozen Gershwin tunes in fine style, with the emphasis on melody and with orchestration that can seldom be branded as "noisy," even by those with sensitive ears.

Included are "Strike Up The Band," "S'Wonderful," "Fascinatin' Rhythm,"

(Continued on Page 109)

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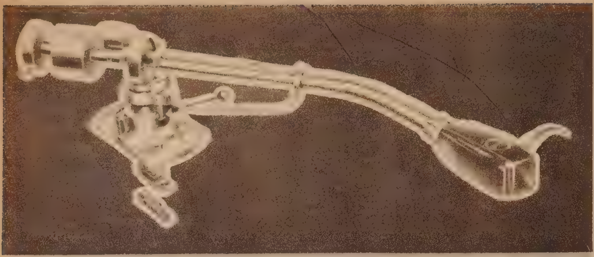

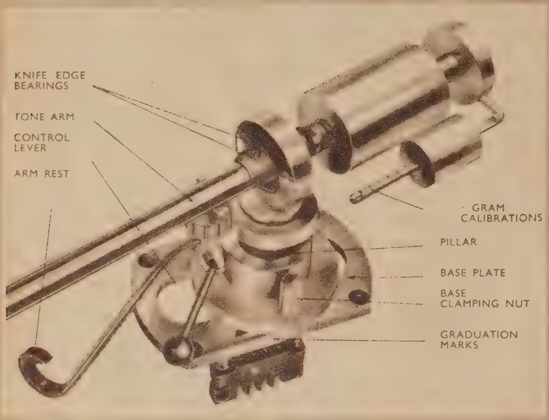

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IN REVIEW—By JULIAN RUSSELL

TRISTAN and ISOLDA —"Superb"

Wagner—Tristan and Isolda. Complete music drama. Birgit Nilsson (Isolda); Fritz Uhl (Tristan); Regina Reznik (Brangane); Tom Krause (Kurvenal); Arnold van Mill (Marke), Vienna Philharmonic Orchestra and Singverein der Gesellschaft der Musikfreunde conducted by Georg Solti. Decca SET 204/8, plus one free 12-inch The Birth of an Opera. (Stereo.) MET 204/8, also with free disc (Mono).

It is safe to phophesy that this will be one of the outstanding sets of the year—or any other year, for that matter. It is a superb example of modern recording technique. It was engineered for home reproduction, and score-followers outraged at slight occasional alterations in the composer's markings of dynamics must keep this fact in mind.

The makers had perfectly valid reasons for these slight changes. Tristan is one of the greatest musical works ever to be composed. Its symphonic structure is faultless, its characterisation subtle, yet wonderfully clear cut.

ESSENTIALLY STATIC

But dramatically it is essentially static, and for that reason its action can be followed quite easily in the mind. Indeed, it has been suggested that its effect might be enhanced if the performers were not seen, but only heard, leaving the listener to form his own pictures of the events depicted in the marvellous score.

Decca have now made this possible, and in doing so have relieved the opera-house audiences' tedium of watching actors standing around doing nothing for long periods. In all of its technical features the set is a brilliant success. Only in a few details of performance does it fall a little short of perfection—as any work of its length and complexity must if presented by human agency.

The opening sailors' song (unaccompanied) in the first act is sometimes a little wayward in pitch. The hunting horns at the beginning of Act 2 sound a little too close in their first bars. And one is forced to picture the shepherd, in Act 3, with two instruments handy to convey his messages about Isolda's absence or arrival to the waiting Tristan.

Usually, in the opera house, he uses a cor anglais to express sadness at the empty horizon and the same instrument to announce joyfully her return. But in an inspired moment the makers substituted an alphorn, a type of wooden trumpet, for the shepherd's joyous news, as originally intended by the composer. The result is an amazingly jubilant sound which lifts the listener's heart in sympathy with Tristan's.

Isolda is one of the most demanding roles ever to challenge a dramatic soprano, and those critics who lament the absence of a Flagstad in the part must remember that when she made her famous recording with Furtwangler she was many years older than Miss Nilsson. The latter may not yet be one of the world's greatest Isolda's, but might easily develop into one with added maturity.

At present she is a warmly feminine princess, youthfully ardent, and one who sings the difficult part with faultless sense of pitch throughout. What she lacks is the commanding presence of a grand manner, through she seldom fails to rise to the occasion when one of the great moments of the score comes along.

Much the same might be said of Fritz Uhl's Tristan. Always the lover, it is sometimes difficult to imagine him as a leader of men. Yet his performance is always exquisitely musical, and, in the third act, supremely moving.

Regina Resnik's Brangane is not always comfortable in the high tessitura of the part, tending to shrillness at times, and lacking in warmth in the comforting phrases of Act 1. But in Act 2 she melts beguilingly into the magic of Wagner's night.

Tom Krause is as fine a Kurvenal as this listener has ever heard — gruffly affectionate, indomitably loyal in his characterisation, and always beautifully expressive in his singing. And the King Mark (Arnold van Mill) is good enough to surmount the tedium of his anticlimactic oration at the end of Act 2.

I can think of no praise too high to describe the playing of the Vienna Philharmonic under Solti. The score glows with a tonal richness rarely heard on records, and Solti's general direction is impressively authoritative without ever becoming tyrannical. The balance throughout has been handled with the greatest possible sensitivity, and the sound, especially in the stereo version, among the finest ever recorded.

An extra disc, which provides some illuminating information about the problems involved in producing this superb set, is included free with both the mono and stereo versions.

★ ★ ★

Beethoven — Piano Concert No. 3 in C Minor, Op. 37. Mozart — Rondos for Piano and Orchestra in D Major (K.382) and A Major (K.386). Annie Fischer and the Bavarian State Orchestra conducted by Ferenc Fricsay. DGG Stereo SLPM138087.

Here is a delicious performance of the concerto with the two Mozart Rondos thrown in as a rich bonus. Miss Fischer overcomes all technical problems effortlessly and offers a reading that is at once freshly conceived, expressively communicated, and inflected with changes of touch that are a delight to ear and mind.

She rises to all the forceful occasions in the first movement, muses poetically over the second, and finishes with a finale as light-hearted as true gaiety can make it. And the inclusion of the Mozart pieces make this eminently desirable disc still more attractive.

The piano sometimes sounds ever so slightly too close to the mike for a perfect balance, but never to the extent of obliterating any of the detail of the admirably played accompaniments. There is a tiny pitch waver at the end of the first side.

Beethoven — Symphony No. 8 in F Major, Op. 93. Columbia Symphony Orchestra conducted by Bruno Walter. Symphony No. 9 in D Minor, Op. 125 (Choral). Columbia Symphony Orchestra conducted by Bruno Walter with Westminster Symphonic Choir and Emila Cundari (soprano), Nell Rankin (mezzo-soprano), Albert da Costa (tenor) and William Wilderman (baritone). Coronet KLCS 2711/2 (Stereo). KLC 2711/2 (Mono).

I found the first and last movements of the Eighth Symphony a little disappointing. Walter seems over-anxious to establish the contrasting moods in the first and lacks brilliance in the last. But the two inside movements are entirely delightful, despite a tempo that some might consider a little slow in the Menuetto.

But the Ninth I can recommend enthusiastically, though there may be listeners who will prefer Klemperer's thrusting interpretation. My own choice goes to Walter's warmer reading which accepts Beethoven's brotherhood of man as already accomplished rather than insisting on its creation, as does Klemperer.

The orchestral playing is never less than satisfying, and the tricky problems of balance between orchestra, choir and straining soloists have been resourcefully managed. For I have yet to hear soloists who can get through their ungrateful parts in the finale of this symphony without some evidence of strain, though Walter's are no worse, or better for that matter, than any others.

The well-disciplined choir responds generously and sensitively to Walter's demands and the whole production strikes me as being as desirable an acquisition to a record library as any version of the work I know.

★ ★ ★

Donizetti—Lucia di Lammermoor. Complete opera. Maria Callas (Lucia); Ferruccio Tagliavini (Edgardo); Piero Cappuccilli (Enrico); Bernard Ladysz (Raimondo); Leonard del Ferro (Arturo); Margreat Elkins (Aliso); Renzo Casellato (Normanno). The Philharmonia Orchestra and Philharmonia Chorus conducted by Tullio Serafin. Columbia SAXO-2316/7. (Stereo).

There is no questioning the dramatic authority of Callas' Lucia in this new set. In this feature it is way ahead of the version she made some years ago. But vocally the earlier set might appeal to those who consider the work purely vocally, despite the prima donna's added subtleties in the later one.

For in the new set Callas once again interrupts passages of peerless beauty with top notes that come perilously close to a screech. Not often, admittedly, but often enough to set sensitive ears wishing they were provided, like eyes, with lids to shut out, momentarily but instantly, unpleasant impressions.

Her support is never very impressive, with Cappucilli professional but uninspiring and Tagliavini at below his best.

Serafin directs the ensembles with all his customary firmness and sense of climax and balance.

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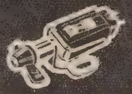

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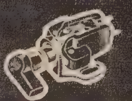

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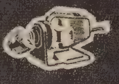

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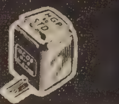

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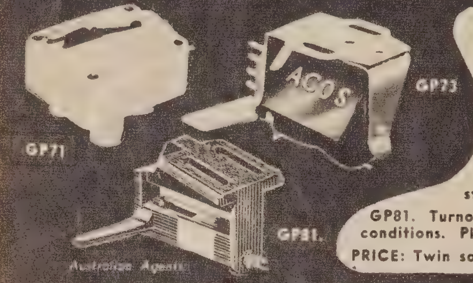

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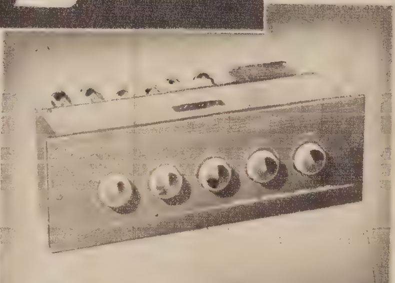

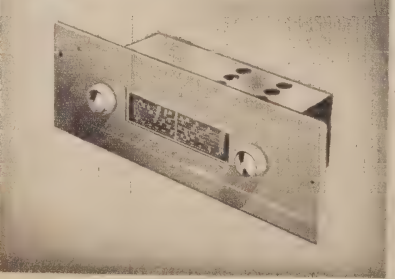

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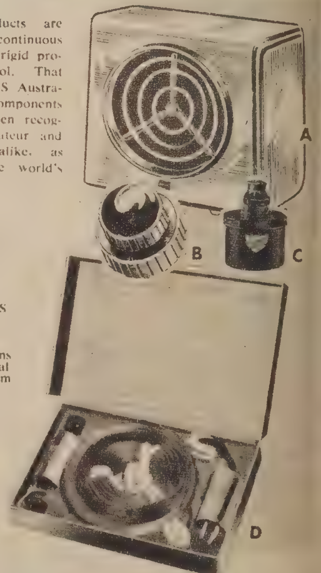

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The sound is only average, and the ore has suffered the usual opera house imming.

★ ★ ★

okofieff—Piano Concerto No. 3 in C. Op. 26. MacDowell—Piano Concerto No. 2 in D Minor, Op. 23. Van Cliburn and the Chicago Symphony Orchestra conducted by Walter Hendl. RCA SL16279 (Stereo). L16279 (Mono).

The only guess one can make at the ddity of this coupling is the fact that liburn has remained attached to the facDowell concerto since his playing of won him an important American prize t the age of 17. But I can't imagine is making admirers of the one comoser wanting to acquire a work by the ther.

It would be difficult to imagine two omposers with wider differences of apeal, though Cliburn plays both compoitions very well indeed. His Prokofieff as an impressive percussive quality adirably suited to the composer's intenions, though a little less pedal in fast assages might have made his excellent rticulation sound even crisper and more etached.

The set of variations that make up he second movement are delivered with ttractive coolness and precision. And if trifle more rhythmic bounce might have dded point to the Finale, it is still attractive as it is.

On the other hand, his presentation of the slight MacDowell piece is ardently omantic, though without gush, suggestng that the young pianist has retained good deal more of his youthful innoence than might be suspected. In both works the Chicago Symphony under Hendl makes a valuable, and always sympathetic contribution.

The sound, apart from a slight dryness in the piano tone, and strings with a touch of steel in the high notes, is good average, though the surface of my pressing was not as clean as one has grown to expect from this label.

★ ★ ★

Verdi — La Traviata. Complete opera Victoria de los Angeles (Violetta); Santa Chissari (Flora); Silvia Bertona (Annina); Carlo del Monte (Alfredo Germont); Mario Sereni (Giorgia Germont); Sergio Tedesco (Gastone); Vico Polotto (Duophol); Silvio Maionica (d'Obigny). Orchestra and Chorus of the Opera House, Rome, conducted by Tullio Serafin. HMV OALP 1780/2 (Mono).

Victoria de los Angeles has many affecting moments in the title role without, however, quite realising either all the passion or all the gaiety that is to be found in it. But she never fails to sing with ravishing purity of tone and an aristocratic sense of phrasing. This is a performance which must be considered with two other considerable competitors — Tebaldi's and Callas', with the former as vocally moving as the latter is dramatically.

While not quite coming between the two, Madame de los Angeles tends to play down her role in a few of its aspects and seldom manages to reach the greatest moments of either of her rivals. But there is a large public for whom she can do nothing wrong, and they might well be convinced of the validity of her restrained reading. If they accept her premise they will find much to enjoy, especially in the mechanical excellence of this set, though a couple of better tape joins would have improved it still further.

Carlo del Monte is uneven as Alfredo. He uses a pleasant voice with excellent musical manners, but never quite succeeds, except for a while in the last act, in bringing the character to life. His father, Mario Sereni, is better, imbuing his part with the understanding and pity he displays so effectively as Sharpless in Puccini's Madame Butterfly, a new set put out by HMV which I propose to review here next month.

The other roles are all most competently filled so that we are left with the conductor, Tullio Serafin. He is a veteran Verdi conductor who probably knows as much about the master's scores, and loves them as dearly, as any man alive today, now that Toscanini is no longer with us.

He uses his experience and affection with fine authority in this new performance, though there are moments when his tempos seem unnaturally slow, and the tension, in one or two spots — the card scene, for one — is unaccountably allowed to drop.

Taking this new set all round, it offers an eminently enjoyable Traviata, if not quite the best. My preference is still for the Decca with Tebaldi, though I am aware that there will be many good judges who disagree with me.

★ ★ ★

Ivan Smith — George Selwyn English. Death of a Wombat. Australian documentary with Alistair Duncan (narrator) and strings, flute, clarinet, French horn, harp and percussion. Hughes—Sinfonietta. Sydney Symphony Orchestra conducted by Nicolai Malko, RCA L16233 (Mono).

This is a locally made disc of considerable merit and RCA are to be admired for their enterprise in issuing it. The Death of a Wombat was originally a radio documentary broadcast by the A.B.C. The author, Ivan Smith, traces with much sensitive perception the progress of a bush fire which begins when a discarded beer bottle concentrates the fierce rays of the sun on to a clump of grass.

The fire is slow to get going, but once established burns out hundreds of miles of bone-dry country with terrifying speed. All the wild life perishes—including a gentle, bumbling old wombat.

George English's musical accompaniment to the well-delivered dialogue is always expertly professional if occasionally derivative in origin. He uses his small combination of instruments with exquisite taste and always finds a felicitous phrase to accompany the description of the action.

My only minor criticism of the whole production is that the onomatopoeic sounds that describe, in the dialogue, the wombat's gallumphing progress are perhaps a thought too repetitive.

The mention of repetition prompts me to wonder just how many times these spoken records are played after the first few runs-through. After you have listened to them two or three times, and then played them to your friends, do they get filed away and produced only when someone turns up who hasn't heard them? I suspect so.

But this disc might well be saved from that fate by the inclusion of the Hughes Sinfonietta, described by Josef Krips as a "little masterpiece," an opinion which

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I unhesitatingly endorse. It says nothing that is outstandingly new, but on the other hand it does not go tiresomely over old, exhausted territory.

Its ideas are always gratefully melodious and the whole is put together very expertly indeed.

There are, to be sure, hints of Shostakovitch in the scherzo, which goes on spiritedly without quite abandoning the bitter-sweet atmosphere of what has gone before. And the jagged broken rhythms are more effectively delivered than the more straightforward ones. But it is, in my opinion, still the most impressive recording of an Australian work ever to be issued here.

Much of this is due to the sensitive and sympathetic treatment it receives from the orchestra under the late Dr Malko. Except for a slightly constricted dynamic range the sound is excellent.

★ ★ ★

Heart of the Concerto—Artur Rubinstein plays the Third Movement of Beethoven's C Minor; Second Movement of Saint-Saens' G Minor; First Movement of Rachmaninoff's C Minor; First Movement of Liszt's E Flat Major; Second Movement of Chopin's F Minor; and First Movement of Grieg's A Minor Concertos. With RCA Victor Symphony Orchestra conducted in Nos. 1 and 3 by Josef Krips and Fritz Reiner respectively, the others by Alfred Wallenstein. RCA L16278 (mono).

This is designed primarily for those who have just started to enjoy music in the form it is offered here — the piano concerto. Old hands will already own their favourite versions of many of the works in their complete performances and are unlikely to be tempted by a movement or so that appeals to them here.

But those who just want to dip into the works, usually represented here by their most immediately attractive movements, should find much to enjoy despite much unevenness in performance and sound due to their having been recorded at different times and places.

This being the case, I shall not enter into any detailed analysis of the different movements, but content myself by saying that with all faults, none is less than enjoyable while others are very good indeed. A very useful buy for beginners.

★ ★ ★

Prokofieff — Scythian Suite, Op. 20 French National Radio Orchestra conducted by Igor Markevitch. Bartok — Dance Suite. Philharmonia Orchestra conducted by Igor Markevitch. Record Society 29-6029. (Mono).

Unlike the preceding disc this is certainly not likely to appeal to beginners, though those whose ears are more accustomed to the sound of a modern orchestra will find no overwhelming difficulties in the way of their enjoyment of this music.

The Bartok offers that composer at his most invigorating. His rhythmic and instrumental invention never flags, and Markevitch reveals a wealth of rich detail in the score while retaining a fluent idiom. The Prokofieff, too, a much harsher, more brutal composition, if one excepts the third movement, should find no shortage of partisan appreciation in the form it is offered here.

Elgar — Symphony No. 1 in A Flat Major, Op. 55. Cello Concerto in E Minor, Op. 85. Andre Navarro (cello). Halle Orchestra conducted by Sir John Barbirolli. Pye Acclaimed series. PLC 5008/9 (Mono).

This was issued back in 1957 in England, but the sound is not to be disparaged because of that, though it never attains the perfection of present-day standards. As to the playing, Barbirolli drives the music on in fine style, exploring its many side issues with a fondness he never allows to distract him from his intensely logical account of the symphony's main stream.

No detail is overlooked, be it passionate or beguiling. Indeed, his bar-to-bar care in his delivery may strike some listeners as slightly overdone when compared to Boult's more relaxed treatment, though I feel that Elgar himself would have been far from disapproving of Barbirolli's. After all, no one liked a good meaty climax more than Elgar and few composers have supplied their brass with such blazing material to work on.

And Barbirolli sends these passages out in great style, approaching them with tension and leaving them quivering in the memory until he enters the composer's next mood. It is the most heady exhilarating performance this listener has ever heard.

I don't think you will be likely to hear a better performance of the Cello Concerto either for a long time to come. Navarro plays it with a ravishing tone and phrasing of the utmost refinement It is only recently that the true worth of this fine work is becoming recognised. This splendid performance presents it in a definitive reading.

★ ★ ★

RECOMMENDED

Tchaikovsky — Symphony No. 5 in E Minor. Ormandy and the Philadelphia Orchestra. Coronet Stereo KLCS2721.

Five Centuries of Spanish Song (1300-1800). Victoria de los Angeles (soprano). Record Society Mono 25-6025.

Tchaikovsky — The Sleeping Beauty. Suite from the ballet. Efrem Kurtz and the Philharmonia Orchestra with Yehudi Menuhin (solo violin). H.M.V. Stereo OASD 371.

Johann Strauss — Die Fledermaus. Gerda Sheyrer, Wilma Lipp, Luise Martini, Christa Ludwig, Karl Terkal, Anton Dermota, Walter Berry. The Philharmonia Orchestra and Philharmonia Chorus conducted by Otto Ackermann. Columbia Stereo SAX2336/7.

Mozart — Jupiter Symphony; Haffner Symphony. Josef Krips and the Israel Philharmonic Orchestra. Decca Stereo SXL2220.

Beethoven — "Moonlight" Sonata; "Pathetique" Sonata. Ania Dorfmann. RCA Camden CAM-59.

John McCormack Sings Sacred Music. RCA Camden CAM-62.

Overtures — Hansel and Gretel (Humperdinck); Midsummer Night's Dream (Mendelssohn); Russlan and Ludmilla (Glinka); A May Night (Rimsky-Korsakoff); Prince Igor (Borodin). Silvestri and the Philharmonia Orchestra. H.M.V. Mono. ALP1749.

Spanish Guitar of Laurindo Almeida. Transcriptions of popular classical piano solos. Capital Stereo SP8521.

Italian String Quartet in the 17th Century — Quartetto Italiano. Record Society Mono 28-6028.

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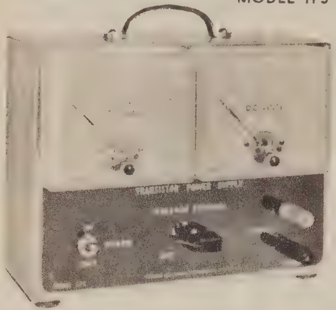

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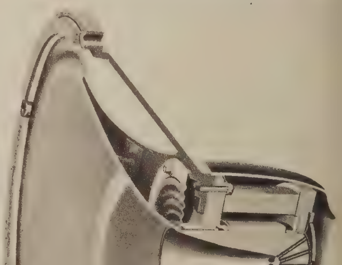

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1961 REMEMBRANCE DAY CONTEST

The Remembrance Day Contest is conducted annually by the Wireless Institute of Australia in memory of radio amateurs who fell in World War II. Stations in all states of Australia represent their Division in it's Quest for the Perpetual Trophy Award.

THE opening ceremony of this year's contest will be performed by His Excellency the Governor of New South Wales Lieutenant-General Sir Eric Woodward K.C.M.G., C.B., C.B.E., D.S.O., K. St. J., during the period of silence before the commencement of the contest at 1800 hrs. on August 12th. The ceremony will be broadcast over VK2WIA and tapes re-broadcast over the various official W.I.A. stations in the Commonwealth.

The following notes giving contest rules etc., were presented to R., TV and H., by the Federal Contest Committee of the W.I.A.

The Federal Contest Committee of the Wireless Institute of Australia wishes all Australian Amateurs and Shortwave Listeners to participate in the Annual Contest which is held to perpetuate the memory of those Australian Amateurs who gave their lives for their country during World War II. It is held on the weekend nearest to the 15th August, the date on which hostilities ceased in the S.W.P.A.

A handsome perpetual trophy is awarded annually for competition between States, inscribed with the names of those who made the supreme sacrifice, and so, perpetuating their memory throughout Amateur Radio in Australia.

The name of the winning Division each year is also inscribed on the trophy. In addition, the winning Division will receive a suitably inscribed framed photograph of the trophy.

OBJECTS: Amateurs in each Call Area (this includes those in Australian Mandated Territories and Australian Antarctica) will endeavour to contact Amateurs in all other Call Areas (VK1 and VK2 are considered to be the one Call Area. Likewise VK5 and VK8.)

DATE OF CONTEST: 12th and 13th August, 1961.

DURATION: From 1800 hours E.A.S.T., 12th August, to 1759 hours, E.A.S.T. on 13th August, 1961. A period of 15 minutes' silence will be observed by all stations on the 12th August, immediately prior to the start of the contest when an appropriate broadcast will be made from VK2WIA and relayed by the Divisional Stations.

RULES

There shall be four sections to the contest:

(A) Transmitting Phone.
(B) Transmitting CW.
(C) Transmitting Open.
(D) Receiving Open.

2. All Australian amateurs may enter the contest whether their stations are fixed, portable or mobile, but only members of the W.I.A. are eligible for the awards. Portable/mobile operation is defined as transmitting and/or receiving equipment which is not connected to any private or public power mains or plant.

3. All amateur frequency bands may be used, but no cross-band operation is permitted.

4. Amateurs may operate on both phone and CW during the contest (e.g. phone to phone, CW to CW, or phone to CW and vice versa), but may submit an entry for only one of the above sections listed in Rule 1.

An open log will be one in which points are claimed for both phone and CW transmissions.

A contestant transmitting on phone but receiving on CW must enter for the phone section (and vice versa). Refer to Rule 11 concerning entry in logs.

5. Only one contact per station per band is allowed and arranging schedules for contacts on other bands is not permitted.

6. Only one licensed amateur is permitted to operate any one station under the owner's call sign. Should two or more operate any particular station, each will be considered a contestant and must submit a separate log under his own call sign.

Contestants operating stations other than their own shall be referred to, for the purpose of these rules, as "substitute operators." Their operating procedure shall be as follows:

Phone contacts: Substitute operators will call "CQ Remembrance Day" followed by the call sign of the station they are operating and the word "log" followed by their own call sign.

CW contacts: Substitute operators wil call "CO RD de" followed by the group call sign comprising the call sign of the station they are operating, an oblique stroke, and their own call sign.

Contestant receiving signals from a substitute operator will qualify for points by recording the call sign of the substitute only.

7. Entrants must operate within the terms of their licences.

8. Cyphers: Before points may be claimed for a contact, serial numbers must be exchanged and acknowledged. The serial number of five or six figures will be made up of the RS (telephony) or RST (CW) reports plus three figures starting from 001 for the first contact, which will increase in value by one for each successive contact. If any contestant reaches 999, he will start again with 001.

9. Entries must be set out as shown in the example, using only one side of the paper, and wherever possible standard WIA log sheets should be used. Entries must be postmarked not later than September 2nd, 1961 and addressed to the Federal Contest Committee, W.I.A., Box 851J G.P.O., Hobart, Tasmania.

10. Scoring will be based on the table shown:

SCORING TABLE

	VKO	VK1	VK3	VK4	VK5	VK6	VK7	VK9
VKO	—	6	6	6	6	6	6	6
VK1-2	6	—	1	2	3	5	4	6
VK3	6	1	—	3	2	5	4	6
VK4	6	1	2	—	3	6	5	4
VK5-8	6	2	1	3	—	5	4	6
VK6	6	1	2	4	3	—	5	6
VK7	6	2	1	4	3	5	—	6
VK9	6	1	2	3	4	5	6	—

Note: Read table from left to right for points for the various call areas.

In addition a bonus of 25 points may be claimed for the first contact in each call area on 50 Mc or above.

11. All logs shall be set out as in the example shown and in addition will carry a front sheet showing the following information:

Name .... Section ....
Address .. .. Call Sign ....
Claimed Score ....

Declaration: I hereby certify that I have operated in accordance with the rules and spirit of tne contest.

Signed ....
Date ... .

All contacts made during the contest must be shown in the log submitted (see rule 4).

Entrants in tne open sections must show phone and CW contacts in numerical sequence.

12. The right to disqualify any entrant who, during the contest, has not observed the regulations or who has consistently departed from the accepted code of operating ethics.

13. The ruling of the federal contest committee of the W.I.A. will be final. No disputes will be entered into.

14. Certificates will be awarded to the winners of the Phone, CW, Open and Receiving Sections in each call area (Northern Territory will count as a separate call area). There will be no outright winner for Australia. Further Certificates may be awarded at the discretion of the Contest Committee.

The State to which the Perpetual Trophy will be awarded shall be determined in the following way: To the average of the top six logs shall be added a bonus arrived at by adding to this average, the ratio of logs entered to the State Licenses multiplied by the total points from all entries. Acceptable logs shall show at least five valid contacts.

The trophy shall be forwarded to the winning State in its container and will be held by that State for a period of 12 months.

RECEIVING SECTION

1. The Receiving Section is open to all shortwave listeners in Australia but no transmitting station may enter.

2. Contest times and logging of stations on each band are as for transmitting.

3. All logs shall be set out as shown in the example. Logs must show first the call sign of the station calling (not the station being called), the serial number sent by it and then the call sign of the station being worked. The scoring table to be used is the same as that used for transmitting and points must be claimed on the basis of the State in which the receiving station is located. A sample log is given to clarify the position.

It is not sufficient to log a station calling CQ, nor is it permissible to log a station in the same call area as the receiving station. For purposes of the contest VK1 and VK2 are considered to be in the same call area, likewise VK5 and VK8.

4. A station heard may be logged once on phone and once on CW for each band.

5. Club receiving stations may enter for the Receiving Section of the contest, but will not be eligible for the single operator award.

However, if sufficient entries are received a special award may be given to the top scoring receiving club station. All operators must sign the declaration.

AWARDS: Certificates will be awarded to the highest scorer in each call area. Further certificates may be awarded at the discretion of the Federal Contest Committee.

NOTE: The F.C.C. emphasises the need for strict observance of Rule 9 in the Transmitting Section and Rule 3 in the Receiving Section.

(Continued on Page 97)

Surely one of the strangest beard trims in history! Sam Harris of Medfield, Mass., U.S.A., trims his beard with scissors actuated by moon bounce signals. The equipment was demonstrated at the Hudson Amateur Radio convention at the Statler-Hilton Hotel, New York and attended by some 5000 amateurs. Sam Harris, a designer of microwave equipment by profession, and an amateur operator by avocation, estimated that his moon-bounce signals travelled approximately 523,000 miles to actuate the scissors which clipped his beard.

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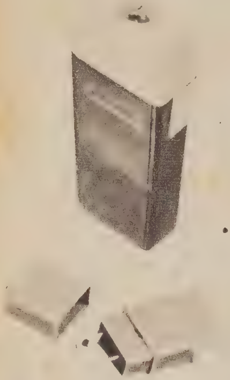

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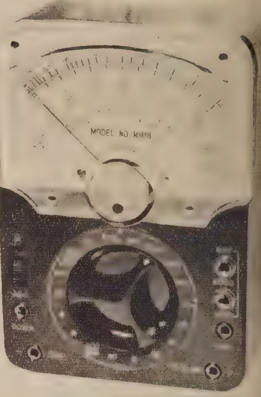

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Resistance: 0-10K, 0-100K, 0-1Meg, 0-10 Meg (62 Ohms, 620 Ohms, 6.2K, 62K at centre scale)
Capacitance: 0.0001uF-0.005uF
0.005uF-0.1uF
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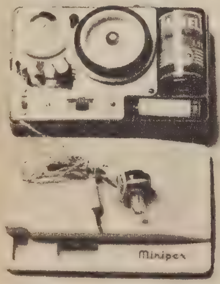

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Priced £12/10/-.
Complete with earphone and mike combined.

SPECIFICATIONS

Fitted with batteries, Standard Torch Cell and 9 Volts Transistor Battery No. 216. Recording time 9 minutes. 60ft full Track Tape. Standard Recording Tape used 200ft for 9/6, enough to fill the supply reel 3 times. Spare reels available. Variable Speed Control. Erases Automatically as it records. Freq. response 300cps to 4000cps. Weight approx. 1lb. Battery life 5 hours. Standard Cell 80 hours Type 950.

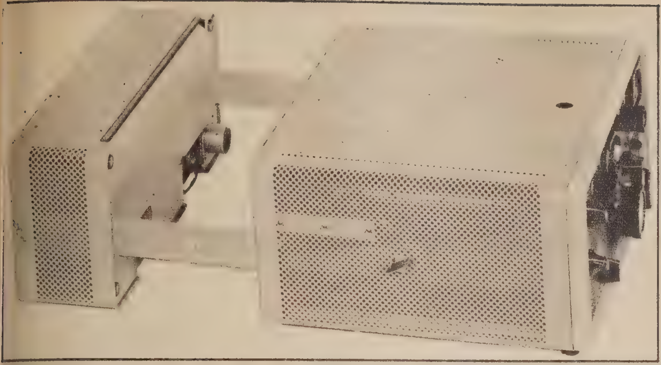
SHAVER

This electric type shaver operates from two 935 standard torch batteries fitted inside the shaver. No wires or outside power; just switch ON and shave. Head easily removed for cleaning.

Complete with batteries, £2/19/6
Spare batteries, 2/10.

RADIO HOUSE PTY. LTD.

296 PITT STREET, SYDNEY.
Also at 760 George St., and 6 Royal Arcade.



For the amateur who likes to travel, the Collins Radio Company have introduced this complete SSB transceiver. Weighing only 13½ pounds, complete with supply as at rear, it can operate from 115 to 240 volts AC at 50-400 cps. Housed in a light suitcase, with pockets for mic., key, aerial wire and miscellaneous items, the complete station weighs less than 45 pounds. (Cedar Rapids Division, Collins Radio Company, Cedar Rapids, Iowa, U.S.A.).

EXAMPLE OF TRANSMITTING LOG

Date/Time E.A.S.T.	Band	Emission	Call Sign	RST Nr. Sent	RST Nr. Recvd.	VHF Bonus	Points Claim	

Note: Standard W.I.A. log sheets may be used to follow the above form.

EXAMPLE OF RECEIVING LOG (VICTORIAN S.W.L.)

Date/ Time E.A.S.T.	Band	Emission	Call sign heard	RST Nr. Sent	RST Nr. Recvd.	Station Called	VHF Bonus	Points Claim	——
Aug. '61									
12 1802	7 Mc	A3	VK5XU	59001	——	VK3XU	—	2	——
12 1805	7 Mc	A3	VK6RU	56004	——	VK9DB	—	5	——
13 1115	50 Mc	A3	VK4RZ	47135	——	VK5QR	25	3	——

Note: Standard W.I.A. log sheets may be used to follow the above form.

EMERGENCY NETS

ORGANISED Amateur Radio Nets for emergency working during national disasters exist in most countries. Planning for these systems has generally been carried out along similar lines with the National Amateur Radio Society providing financial and administrative support. WICEN is the WIA's official system and most licensing authorities support such nets. In the U.S. one organisation is government-sponsored as a combined activity of the office of Civil and Defence Mobilization and the Federal Communications Commission.

The U.S. Radio Amateur Civil Emergency Service (RACES) was created in 1952 by the F.C.C. and the then Federal Civil Defence Administration primarily to serve the nation in a Civil Defence emergency. Out of the total of 200,000 licensed amateur radio operators some 35,000 who are now members of RACES will help to provide radio communication needed by Federal, State and local governments in time of emergency.

RACES emergency communications plans are originated by local civil defence organisations approved by the CD HQ's in any State and final authorisation is granted for operation by the F.C.C.

Operators have a twofold activity program both in peacetime and in wartime. In times of natural disaster they will handle messages for police, fire, public utility and other emergency services and will participate in Civil Defence exercises.

Those stations will be the only amateur radio stations allowed to operate in the event of enemy attack. Upon warning of war all normal amateur radio operations must cease for security reasons. It is expected that much of the normal communications facilities over the nation would be damaged and RACES stations would then supplement the surviving facilities in handling official information for the various authorities.

Stations of the RACES system operate under the direction of State or Local Government officials in conformity with civil defence communications plans of these governments. Operating frequencies allotted by the F.C.C. are restricted to small fractions of the regular amateur bands (i.e. 7097 to 7103, 7103 to 7125 and 7245 to 7255 Kc/s in the 7 Mc/s band).

Every RACES Station is a member of one or more networks which link town and city control centres with outlying areas, country to State, State to Federal Control Centres.

Any radio amateur is eligible to enroll in RACES and selected disposal equipment is available for RACES use on a subsidised basis. Some 1,400 RACES plans (net organisations) exist in the U.S. set up in the various States, some State-wide, others only covering small sectors.

Besides this RACES activity amateurs conduct their own Amateur Radio Emergency Corps under the auspices of the A.R.R.L. Emergency co-ordinators are appointed in the various sections and the States have their own A.R.E.C. communications plans. It is via these A.R.E.C. nets that most of the traffic is carried during time of disaster and each month in Q.S.T. stories of the Corps' activity in the public service can be read.

GENEVA ALLOCATIONS

AMATEURS in many countries of the world operated under the Geneva Conference Frequency allocations from May 1st. Here in Australia we await the results of the deliberations of the Radio Frequency Allocation Review Committee which will be presented to the Postmaster-Generaeral before tabling in the House of Representatives. Until the necessary formalities have been carried out Australian amateurs will not know the frequencies that will be available to them in the future.

Throughout the world the actual frequency allocations now in use by amateur stations vary in different areas. The most serious loss in most cases was the restricting of the 7 mc/s band to 7.0 to 7.1 mc/s. Generally speaking amateurs could be well pleased by the work of their delegates at the Geneva Conference and the outcome of the deliberations. Tremendous pressure was brought to bear for additional frequencies for their services and amateurs could well congratulate themselves on the outcome.

As a typical example, the following are the frequencies available to U.K. amateurs, their only loss 50 kc/s from the 7 mc/s band. In brackets is the maximum DC power input permitted for use.

1.8 to 2 mc/s (10 watts), 3.5 to 3.8, 7.0 to 7.1, 14.0 to 14.35, 21 to 21.45 and 28 to 29.7 mc/s (150 watts), 70.2 to 70.4 mc/s (50 watts), 144 to 146, 420 to 450, 1215 to 1325, 2300 to 2450. 3400 to 3475, 5650 to 5850, 10,000 to 10,500 and 21,000 to 22,000 mc/s (150 watts). Above 425 mc/s special segments are set aside for amateur television transmissions and above 2350 mc/s for pulse transmissions.

There are some limiting restrictions on operation where bands are shared with other services. The R.S.G.B. considers the part played by I.A.R.U. and National Amateur Radio Society representatives was important in obtaining the bands as listed and due credit should be paid to their endeavours.

TASMANIAN DIVISION

THE Tasmanian Division of the W.I.A. will assist the Australian Boy Scout movement during their camps to take place on the weekend October 21 and 22. As in previous years, members will set up amateur radio stations at the various points and provide an interesting demonstration on the workings of the hobby to young people, a number of whom may one day join the ranks.

The Federal Contest Committee for 1961-62

The RADIOMASTER

RADIOGRAM CHASSIS . . .

A great performer on Radio and Records

STEREO MODEL S77 gives glorious three-dimensional sound that comes from everywhere in the room. Features include dual treble, bass and volume controls, also balance control. Broadcast and short-wave radio. Seven valves. Single chassis. Two speakers.

PRICE £38/10/-

STEREO MODEL S77A. Five-valve amplifier. Only £29/10/-

STEREO MODEL S66. Six-valve radiogram chassis £31/10/-

STEREO MODEL S66A. Four-valve, 8 watt amplifier. Colossal performance. Only £19/19/-

All Prices include Speakers
Freight extra.

RADIOGRAM—TV & STEREO CABINETS

Twenty popular designs are available, including combination Radio-TV-gram. All colours, first-class finish.

New models for stereo include built-in speaker enclosures and two and three unit sets. We will make your stereo furniture to order. Quotations given. TV cabinets can be supplied complete with brackets and straps for picture tube mounting.

ALL TYPES OF FOUR-SPEED AND STEREO RADIOGRAM UNITS

PICTURE TUBES NEW 23 in £25

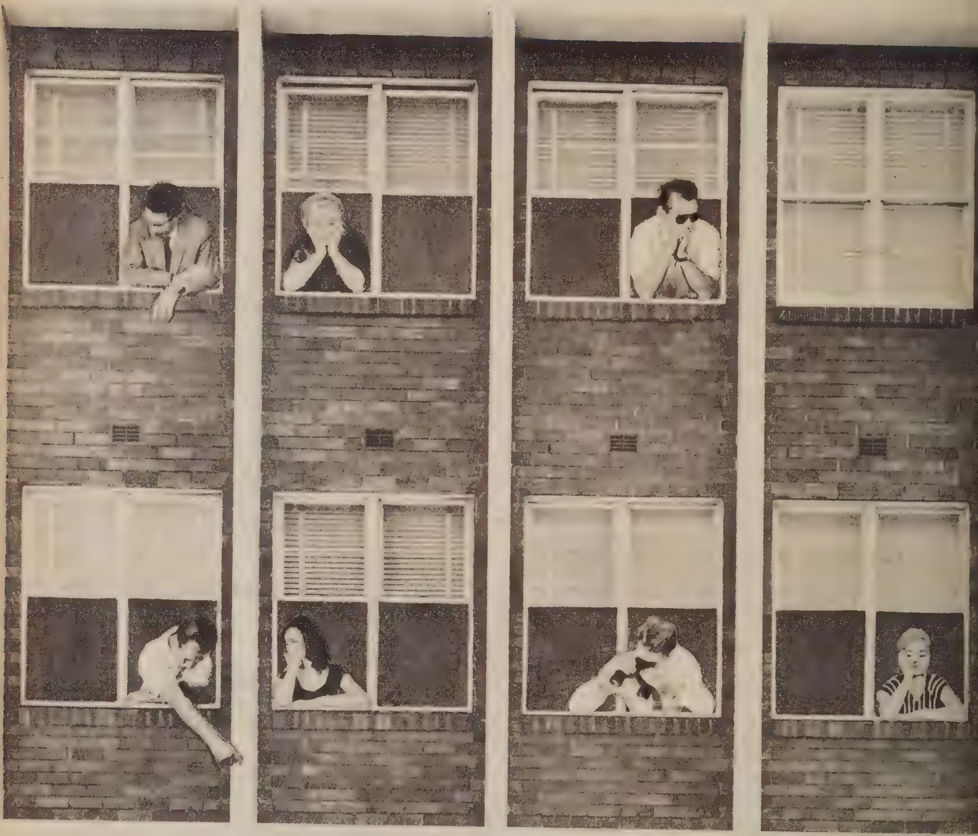
TV ANTENNAS, 30 models, from £2

WRITE FOR CATALOGUE

H. B. RADIO PRODUCTS
103-105 Catherine Street,
Leichhardt, SYDNEY.
Telephone LM5580

Pick the Person

WHO HAS A *Super* RADIOTRON PICTURE TUB



AWV

The occupant of Apartment 16 is like most other people when it comes to watching a march, and yet his window remains shuttered, even while the marchers pass directly below.

The answer is a simple one—his TV set is powered by a SUPER RADIOTRON picture tube and, like other fortunate owners, he prefers to watch his marches from the comfort of a favourite easy chair.

For all the advantages of "on-the-spot" viewing plus razor-sharp focus, insist that your picture tube replacements are SUPER RADIOTRON.

Made in Australia by

AMALGAMATED WIRELESS VALVE CO. PTY. LTD., Sydney, Melbourne, Brisbane

again comprises members of the Tasmanian Division.

The members are as follows: E. J. Cruise, VK7EJ; J. Batchler, VK7JB; K. Spiegel, VK7KS; . Nichols, VK7RY; and G. D'Emden, VK7ZAS. These amateurs are responsible for the conducting of all Federal contests on behalf of the W.I.A. There is plenty of work entailed in drawing up rules, checking logs, etc., and they must be congratulated on the duties performed on behalf of their fellow amateurs.

GRIFFITH CLUB

AT the anual meeting of the Griffith Radio Club, Ted Druitt, VK2AXD, was elected as president and Ray Spratt, VK2AYZ, as secretary. The club has plans for a comprehensive program for the ensuing year.

Another N.S.W. divisional appointment was that of Dave Duff, VK2EO, to the position of chairman of the VK2WI Dural committee. The committee is working hard to improve facilities, technical and social, at the VK2WI centre.

LECTURES

LECTURES presented at June meetings of the N.S.W. W.I.A. Division and its sections included one by Vol Molesworth, VK2VO, at the division's mid-month meeting. The subject covered the wrecking of disposals gear—getting the most out of this equipment in one piece.

Harold Burtoft, VK2AAH, lectured on one of his favourite subjects, Antennas, to a record attendance at the Blue Mountains Section's June gathering. Judging from the late hour it finished and the barrage of questions he answered it was well received.

Lecturer at the division's general meeting held at Science House was Eric Warren, of D.C.A. Mr Warren offered an interesting comparison between the effectiveness of valves and transistors at HF, VHF and UHF. He covered all aspects of their operation and evaluated their respective uses.

HUNTER BRANCH

Forthcoming lectures at the Hunter branch include one on "A Phasing Type of Filter Sideband Generator" to be presented by Dr Leo McMahon, VK2AC on August 11th, Keith Jeffcoat, VK2BK, will lecture on "Improving receiver performance" at their September meeting to be held on Sept. 3. Both will be given at the usual meeting place, The University of N.S.W., Tighes Hill, Newcastle.

The branch is already proceeding with organisation for their Annual Dinner and Field Day on the 6-hour day holiday weekend, Sept. 30 and Oct. 1. The South Western Zone, N.S.W. W.I.A. will also hold their convention over the same weekend.

G2NM

WITH the passing of Gerald Marcuse, G2NM, in April at the age of 74, the U.K. lost one of its outstanding amateurs. Gerry was perhaps best known for his shortwave broadcasts in the 1920s, the forerunner of the B.B.C.'s world-wide S.-W. service. He was a past president of the Radio Society of great Britain and a founder vice-president of the International Amateur Radio Union. G2NM's whole life was dedicated to amateur radio and many were the duties he performed on behalf of his fellow amateurs.

Some decisions of the 1961 Board Meeting of the A.R.R.L. will have some bearing on amateurs in other countries. Perhaps the most important decision from that viewpoint is the strong recommendation to all U.S. amateurs to avoid use of the 14 mc/s telephony band segment 14.335 to 14,350 kc/s so that overseas S.S.B. stations might successfully operate there.

The League will seek the issuance of a commemorate postage stamp for amateur radio in 1964, the year of the 50th anniversary of the foundation of the A.R.R.L.

HO was instructed to use G.M.T. exclusively in all A.R.R.L publications and literature. The appropriate committee was requested to study the possible publication of a VHF Handbook and a 10-year index for QST, both would be valuable assets in any shack. In the regulations field the A.R.R.L. will seek changes in rules to permit slow-scan facsimile/TV in the telephony segments, on 21 and 28 mc/s. They will also move for world wide privileges on 14 mc/s for U.S. Maritime Mobile stations and to change several licencing procedures.

An interesting case in which proceedings covered more than two years resulted in the suspension of W6VSS's amateur licence for a period of one year. The F.C.C. proceeded against the amateur on a number of infringements of the regulations. The modus operandi to find some of the "Corn Fed" kilowatts in action is quite interesting.

During the 1959 A.R.R.L. DX contest F.C.C. personnel monitored W6VSS's transmissions from two vehicles located about two streets away from his QTH.

After field strength measurements had been made one of the inspectors proceeded to the house to examine the equipment in use, the other remained in his car to make comparison readings. During test transmissions after the arrival of the inspector the signal had substantially less power, recording 51,000 micro volts against the 90,000 micro volt signal originally recorded. On measuring W6VSS's transmitting power it was shown that the input was still in excess of 1 kw at 1400 watts.

It was suspected that the primary voltage had been reduced from 220 to 110 volts. The story was covered in June QST.

SCOOP PURCHASE MULTIMETERS

TMK MODEL 200

D.C. Volts 0-1200. A.C. Volts 0-1200. Ohms 0-10K.0-100K. 0-1 Meg 0-10 Meg. D.C. Current 0-60uA - 600 MA. Capacitance 0002 uF .02 MFD 20,000 Ohms per volt.
Only **£7/15/-** each.

SCR522 TRANSCEIVERS
100-147 Mcs.
Complete with 18 valves.
Power supply (24v. DC).
Push button control box.
Circuit. **£8/17/6.**

OPERATOR'S KIT
Contains 1 carbon mic.
1 set headphones.
1 Morse key **21/6.**

AIRCRAFT LANDING LIGHTS
With High Grade Polished Reflector **9/6 ea.**

MICRO SWITCHES 3/- each

OAK SWITCHES
1 Pole 12 Position
2 Bank. **9/6 ea.**

JENSEN SPEAKERS 3½ inch with 6,000 Ohm Transf. **17/6.**

A.W.A. 2 Gang Condensers
Standard. 7/6 ea.
Miniature. 9/6 ea.

"S" METERS
ILLUMINATED 3MA. FSD
35/- ea.

FUSES
5 amp. and 500 mill. amp.
6d. ea.

Aluminium Carry Racks
with shock mounts. Ideal Mobile Rig 5¼in x 10¼.
New 12/6 each.

VCR97 Cathode Ray Tubes
6in Brand new in carton, as used in R. TV & H. circuits.
12/6 each or 2 for £1

13 Valves American Receiver. Type CG-46068 60-80 Mcs
£9/10/-

VALVES

6V6	12/6 ea.
6J6	9/6 ea.
2051 & 2050 Thyratron	9/6 ea.
VR105/30 & VR150	10/ ea.
6SN7 6SL7	10/ ea.
6J5	10/ ea.
6AC7	5/6 ea.
7C5 with Socket	5/6 ea.

Noise Limiter Kit
Navy Design 7, fit to almost any Receiver. Complete Kit of Parts and circuit with Instructions How to fit.
17/6 each

7 Pin Min Ceramic Sockets and Shields	2/6 ea.
Fuse Holders (1 Hole Mounting)	2/6 ea.
Tag Strips, 1 Doz. Mixed From 4 Tag to 9 Tag,	7/6 doz.
TV IF Formers and Can with Slug	2/6 ea.
FORMERS ONLY	1/- Doz.
1mfd 600V Block Condensers	2/6 ea.
Phone Plugs	2/6 ea.
2 Phone Plugs with cords	4/6 ea.

Key Switches Asstd. Types	**2/6 ea.**
B/Cast Coils Aer. Osc. RF. Known make	**5/ ea.**
7-Pin Miniature Valve Straighteners	**9/6 ea.**
Relay Counters. 0-9999	**7/6 ea.**
Head Phones, low imp.	**13/6 pr.**
8mfd 440 volt A.C. oil filled	**7/6 ea.**
SCR 522 Control Boxes with 5 position Push Button Switches	**12/6 ea.**
70 Deg. Yokes New	**30/- ea.**
Carbon Mic Inserts	**2/ ea.**
Grammo Motors 240 Volt Suit Tape Recorders, etc.,	**17/6 ea.**
Bowden Cables. 6ft	**5/ ea.**

ALL ARTICLES PLUS FREIGHT

PARAGON RADIO

479 PARRAMATTA RD,. LEICHHARDT
LM9402 TOP TAVERNERS HILL

NEW *Releases!*
IN HI-FI TAPE RECORDERS

Model TR2 incorporates the new Collaro "Studio" Deck which features:–

- Amplifier using six valves and rectifiers.
- Separate bass and treble controls.
- Monitoring facilities.
- High Fidelity. Frequency response 40 to 12,000 cycles at 7½in per second.
- Three 4-pole shielded motors.
- Three speeds, 1-7/8, 3¾ and 7½.
- Fast forward and rewind, 1200ft in 65 seconds.
- Two track.
- Light piano key controls.
- **PAUSE CONTROL**

This has the effect of stopping the transit of the tape past the "Record' Playback" and "Erase" heads and applying the brakes to the spools while leaving all switches and mechanical functions in their selected positions. Typical application is to pause whilst recording to omit speech interposed between musical selections. Control will only work whilst it is held in position.

- **TAPE MEASURE AND CALIBRATING DEVICE**

The three digit counter makes the location of any recorded passage the simplest of operations.

- **TRANSCRIPTION TECHNIQUE**

A large diameter flywheel with ground and lapped steel shaft running on a ball at the bottom of long bearing reduces friction and virtually eliminates "wow" and flutter at less than 0.15 per cent at 7½in per second.

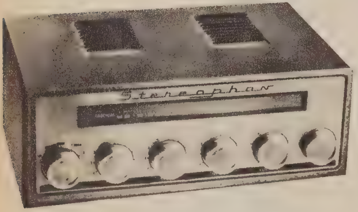
THE COMPLETE UNIT IS SUPPLIED IN ATTRACTIVE AND DURABLE TWO-TONE COVERED CASE COMPLETE WITH ACOS MICROPHONE AND FITTED WITH DUAL SPEAKERS.

The amplifier incorporates the latest "Mullard" tape recorder circuit equalised to C.C.R. standards giving perfect reproduction from recorded tapes. Outlet to power amplifier. Extension speaker outlet and "magic eye" level indicator. Amplifier is completely shielded and fitted with dress plate to match deck. Output: 4 watts can be used as straight amplifier if required.

COMPLETE RECORDER WITH MIKE 69 GNS. f.o.r.

A COMPLETE HI-FI STEREO SYSTEM FOR ONLY 59 GNS. F.O.R.

UNIT STEREO PLAYMASTER AMPLIFIER No. 2 WITH PLAYMASTER TUNER



—SPECIFICATIONS—

- Output 7 watts per channel (14 watts).
- Ferguson Output Transformers.
- Inbuilt Tuner with new EM 84 tuning indicator, frequency coverage 550 to 1,600 KC.
- Valves 4 6BM8—1 12AUF—1 6N8—1 6AN7—1 EM84—2 1N1763 Rectifiers.
- Supplied in self-contained case finished in beige, hammertone, with black and gold control panel with matching knobs.
- Switching and input facilities for pick-up—radio, F.M. Tuner and Tape Recorder.

PLUS THE NEW B.S.R.-UA12 STEREO CHANGER

AND TWO MAGNAVOX 8W.R. HI-FI SPEAKERS GIVING A FREQUENCY RESPONSE OF 40 TO 12,000 CYCLES

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145

CLASSIC RADIO TAKE PRIDE IN ANNOUNCING COMPLETE RANGE OF STEREOPHONIC EQUIPMENT

Stereophon LIVING SOUND

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16 VALVE HI-FI STEREOGRAM CHASSIS

omplete tuner and amplifier for stereo, comprising a compact Hi-Fi Stereogram in two units featuring a high gain ual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls in one unit and wo Mullard 5-10 amplifiers with push-pull outputs and power supply on second chassis. **£69/15/-** F.O.R.

wo pair of M.S.P. Jensen speakers or two Rola 12in dual coned speakers supplied. Power output 10 watts per channel (20 watts). Frequency sponse of amplifier 40 to 15,000 cycles.

THIS UNIT CAN NOW BE SUPPLIED WITH THE NEW ROLA 12 PX SPEAKERS

---

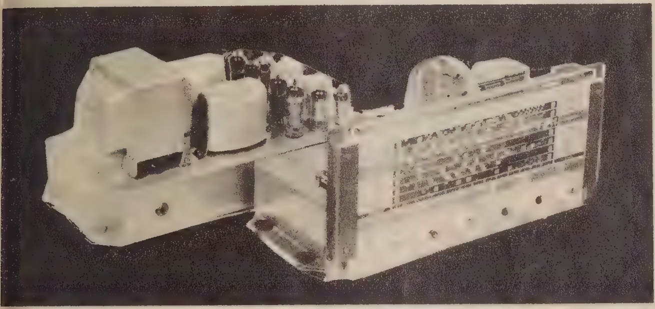
10 VALVE HI-FI STEREOGRAM CHASSIS

omplete stereo unit comprising dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with ne controls and two Mullard 3-3 amplifiers, power supply on separate chassis. Supplied with two Rola 8MX peakers. Power output 4 watts per channel. Frequency response of amplifier 40 to 15,000 cycles. **£49/15/-** F.O.R.

---

8 VALVE HI-FI STEREOGRAM CHASSIS

omplete tuner and amplifier for stereo incorporating the "Mullard 2-2" amplifier circuit with separate bass and eble controls. Output 3 watts per channel. Supplied with two Rola 8MX speakers. Frequency response 50 to 0,000 cycles. **£41/15/-** F.O.R.



ALL UNITS INCORPORATE THE NOW FAMOUS "MULLARD" AMPLIFIER & TONE CONTROL CIRCUITS.

Write for Full Specifications of STEREOPHONIC EQUIPMENT OR TAPE RECORDERS

SPECIFICATIONS OF OUR NEW HI-FI CHASSIS

NEW:

Ultramodern circuit using high gain valves including "magic eye" tuning indicator. Permatuned iron cored coils and intermediates giving excellent interstate reception and a short-wave range of 12,000 miles. All valves used are the new Mullard nine-pin Innoval series.

NEW:

Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate bass and treble controls giving plus or minus 15 db boost or cut at 50 cycles L.F. and 10,000 H.F., combined with push-pull output with inverse feed-back gives you really high fidelity reproduction from your radio or favourite recordings.

NEW:

Dual speaker combination using the new Jensen M.S.P. 12PR woofer with matched tweeter and cross-over network giving a frequency response of 40 to 12,000 cycles. If required the Rola 12MX speakers can be supplied (with the 8 valve stereo chassis, two Rola 8MX speakers are supplied). A.W.A. output transformers used on all units.

NEW:

Six position selector switch is incorporated in all chassis with compensation for L.P. recordings and provision for stereo F.M., or TV tuners and tape recorder.

NEW:

Large calibrated edge-lit dial in perspex (11in x 6in) with main stations of each State in prominent type. Dial fitted with counterweight drive, giving smooth tuning. Dial supplied in cream with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW:

Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate, overseas and country stations.
All chassis are wired for the fitting of F.M. tuner or tape recorder, special plug being provided on back of chassis, also pick-up terminals and outlet for gramo. motor.
Power switch is fitted to volume control. Audio end of set can be used with TV receiver if required.

COMPLETE RANGE OF DUAL, COLLARO, B.S.R. AND GARRARD, STEREO PLAYING EQUIPMENT IN STOCK

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145.

PHILIPS

Television Sweep and Marker Generator

TYPE GM 2875

for fast accurate alignment

FEATURES

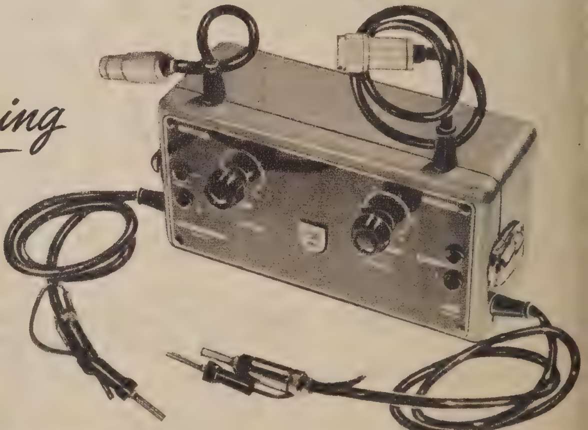
- Extremely high stability
- Frequency range from 5-220 Mc/s continuously variable.
- Internal 50 cycle frequency modulation.
- Sweep width of 0-25 Mc/s continuously variable.
- Built-in Crystal Oscillator.
- Marker Oscillator 25-55 Mc/s calibrated harmonics up to 220 Mc/s.

£140 plus S.T. 12½%.

PHILIPS Transistorised Marker Mixing Amplifier

TYPE GM 2876

for constant amplitude marking



The combination of the GM 2876 with the GM 2875 Sweep and Marker Generator permits an amplification of the frequency marker the size of which is independent of its position on the frequency response curve.

FEATURES

- Built-in variable AGC bias.
- Battery-operated.
- Fully-transistorised.

PHILIPS ELECTRICAL INDUSTRIES PTY. LIMITED

SYDNEY • MELBOURNE • BRISBANE • ADELAIDE • PERTH • HOBART • NEWCASTLE • CANBERRA • WOLLONGONG

P2346-60

ON SHORTWAVE — By ART CUSHEN

COLOMBIA, VENEZUELA, BRAZIL

he reception last month of the new Radio Nacional de Ecuador, has een followed by signals on new frequencies from Nacional Radios in Columbia, Venezuela and Brazil.

NEW frequency for the Government-operated Radio Television Nacional de Colombia, dcasting from Bogota has been heard on 3290 The station is carrying the same programs HJCT on 6185 Kc to sign off at 0500 G.M.T. program for the last 30 minutes is of un- rupted music and when closing the station s the program details for the following day's smissions. Signals are good on 6185 Kc, with e side interference, but the reception of the Kc outlet will be restricted to winter listen- It could also be heard at 1130 G.M.T., when used to carry the normal morning programs.

ENGLISH FROM CARACAS

IE first broadcast in English we have heard, from Caracas, Venezuela, was logged on Mon- at 0400 from the Radio National transmitter g 6170 Kc. A report from Sweden states that Europe an additional transmission is heard on rdays from 2330 to 0100 G.M.T., while the day session is from 0230 to 0400. The sta- requests reports from listeners to be sent to lio Nacional Venezuela, P.O. Box, 3979, Cara- Venezuela.

nother Venezuelan, YVKX "La Voz de la ria," on 3305 Kc and opening at 1030 G.M.T., reported from a listener in England to verify a letter card and pennant. in response to rts from listeners.

RADIO NACIONAL, BRAZILEIRA

IE recent moving of the capital of Brazil from Rio de Janeiro to Brazileira has also nt the moving of the key Government radio ion Radio Nacional. The station, with 50Kw smitters, was recently opened at this new site the President of Brazil and it is now active 1210, 6065, 9665 11720 and 15445 Kc. The ector of the station, Radio Nacional de Brazi- a, states that broadcasts in French and Eng- are projected. The broadcasts seems to be a test nature, the outlet on 11720 Kc was rd at 0100, while the transmissions on 6065, 5 and 15445 Kc were heard to sign off at 0 G.M.T. Another station of the Radio Na- nal network, this time in Sao Paulo, has been ed on 6125 Kc with typical Portuguese pro- ms and sign off is at 0500 G.M.T. Signals er some interference, mainly from Madrid on 0 Kc.

CAIRO USING 15115 Kc.

HE test broadcasts of Radio Cairo, using 15115 Kc have been noted at 2000 G.M.T., when y cause considerable interference to the broad- ts of HCJB on the same frequency. The sta- is asking for reports from listeners, giving much detail as possible to be forwarded to lio Cairo, Cairo, Egypt. The transmission is Europe and is additional to the broadcast on 915 Kc which has the news bulletin in Eng- at 2130 G.M.T., in its European service. iro is also using 15115 Kc beamed to South- st Asia, and this transmission is on the air m 1330 to 1400 G.M.T. Another Cairo trans- ssion we hear very well is at 0630 G.M.T., en news is read in English. Frequencies are 745 Kc and 7050 Kc.

TESTS FROM ACCRA

HE recent tests by the Ghana Broadcasting Service, in Accra, seem to have reached ality and a number of frequencies have been ected for use by the four 100Kw transmitters, ently installed. The programs are beamed to parts of Africa and the station is on the air 45 Kc at 1530 to 1930 G.M.T., 11755 Kc at 00 to 1600, 15280 Kc at 1200 to 1730, 11800 at 1700 to 2215 and 7295 Kc at 1800 to 2215 M.T.

From Sydney, one of our readers, Phillip J. ck of Gladesville, reports a number of in- esting transmissions. These include reception Rome (15320 Kc) at 0900, Solomon Island 60 Kc)—reported to have extended its broad- sts from 0830 to 1230—and HCJB in its trans- ssion to Europe. The latter is heard from 1900 2300—English at 2230—on 15115 and 17890. tican Radio has been heard from 2230 to 2245 M.T. on 15120 Kc, Tuesday, Thursday and turday, and the Spanish National Radio using 65 and 6130 Kc is audible from 0315 to 0400, 15 to 0500, and 0515 to 0600 G.M.T. with ograms to North America.

HILVERSUM BROADCASTS

EW frequencies have been put into service in some of the broadcasts from Radio Neth- ands in Hilversum.

Arthur Cushen of Invercargill, N.Z., our shortwave correspondent, at his listening post. Something like 4000 verifications have been received from 183 countries.

The Dutch language transmission to Australia and New Guinea is now heard on 11755 Kc., and is broadcast from 0800 G.M.T.

The English language transmission to North America is on the air from 0130 to 0220 G.M.T. and is now broadcast on 9590Kc. This frequency is also used for the Spanish transmission on the air from 0230-0320. The Happy Station transmission on Monday at 0200 to 0330 G.M.T. is now on 9590 Kc, while the Dutch language transmission on at 1300 to 1450 to West Australia and South-East Asia is now broadcast on 21625 Kc.

ENGLISH FROM DELHI

A NEW schedule of the English news bulletin from the All India Radio station in Delhi has been released and these sessions apply to reception of its External services.

News is carried at 0030 G.M.T., 11895, 9765 Kc, 0430 G.M.T., 21520, 17855 Kc, 1100 G.M.T. on 21615, 17855, 17705, 15310, 15105 Kc, 1330 G.M.T. on 17705, 15365, 1545 G.M.T. on 17830, 15105 Kc, 1945 G.M.T. on 15105, 11955, 9635, 7120 Kc

ANDORRA INTERNATIONAL

A NEW broadcaster from the Principality of Andorra high in the mountains between France and Spain has been heard with its test transmissions. The station announces as "This is Radio Andorra International, broadcasting on 6,195 kilocycles 48 metre band. Dear listeners we would welcome your comments and reports on reception and please address them to Radio Andorra International, Post Box number one, Principality of Andorra." The signals are more on 6200Kc than the announced 6195Kc, and best reception is at 2100 G.M.T. The station announcement in Spanish, French, English and German is made following each second recording in this test transmission.

TIGPH USES 6220 Kc.

BROADCASTS from San Jose in Costa Rica, Central America have been tuned on the new frequency (6220 Kc) for station TIGPH. The station was formerly assigned to 6150Kc, but this new channel outside the normal 48 metre band enables clear reception of the broadcasts. The station has typical Latin American programs with frequent commercial announcements, and sign off is at 0600 G.M.T. The best reception is for the last hour of the transmissions. The station slogan is "Radio Monumental," and the address is Apartado 800, San Jose, Costa Rica.

MONTE CARLO TESTS

RECEPTION of test broadcasts from Transworld Radio in Monte Carlo, Monaco, has been heard by Mr W. Harrison of West Pennant Hills, N.S.W. The station used the frequency of 11805 Kc and made frequent requests for reports from any listener to P.O. Box 141, Monte Carlo. Mr Harrison's reception was from 1510 G.M.T. to sign-off at 1530 G.M.T. and strength throughout this trial transmission was very good in the Sydney area.

FLASHES FROM EVERYWHERE

SOMALI Republic is to have a new shortwave service according to a report from Moscow. The Russians are to supply the country with a high powered transmitter in place of the present lower powered stations at Mogadisho and Hargeisa.

LISBON, Portugal, is being heard in two transmissions in English. The first from 1345 to 1430 G.M.T. is carried on 17880 Kc. The second broadcast takes the air at 1715 to 1800 on 1538 Kc.

KATANGA with broadcasts coming from Elizabethville, was formerly using 11866 Kc, but a Swiss report lists the new frequency as 5977 Kc. The broadcast was heard at 1900 G.M.T. with news in French. The signal was good, until 1930 G.M.T., when interference from the Voice of America is rather severe.

RABAT, Morocco, has been reported as moving from 11735 to 15320 Kc and heard on this frequency with the English program at 1800 G.M.T.

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A WHOLLY OWNED SUBSIDIARY OF MOTOR SPARES LTD.

ITOKA SIGNAL INJECTOR

JUST ARRIVED: Shipment of Itoka Signal Injectors, Model 1T1-1.

This Unit is ideal for service of Transistor Radios, Valve Radios, Television receivers, Amplifiers, Tuners, etc. It produces a signal which makes it suitable for signal tracing in AF, IF and RF circuits, works off 4 penlite cells, has indicator light, measures 1 3/8 x 1¼ x 5in, and weighs only 4oz.

Prices £1/18/6 plus 12½% Tax or £2/3/6 including Tax, plus postage.

M065 MR4P

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JUST LANDED, PANEL METERS
All types, 2.5 per cent accurate. Two models available as follows:

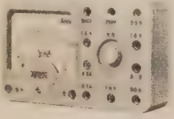
MO 65 Round Black Bakelite case, overall diameter 3⅜ inches.

MR4P Rectangular Plastic Case, overall size 4⅝ x 4⅛.

Prices are as follows:

Type	MR 4P	MO65
50 Micro-amp	£5 10 0	£4 13 0
100 Micro-amp	£4 10 0	£4 1 0
500 Micro-amp	£3 15 0	£3 0 0
1 Milliamp	£3 10 0	£2 2 0
5 Amps	£3 10 0	£2 2 0
15 Amps	£3 10 0	£2 2 0
30-0-30 Amps	£3 15 0	£2 5 0
20 Volts DC	£3 10 0	£2 2 0
50 Volts DC	£3 10 0	£2 2 0
100 Volts DC	£3 10 0	£2 2 0
300 Volts DC	£3 10 0	£2 2 0
20 Volts AC	£3 10 0	—
50 Volts AC	£3 10 0	—
100 Volts AC	£3 10 0	—
300 Volts AC	£3 10 0	£2 2 0
5 Amps AC	—	£2 2 0

Note: All AC Voltmeters are of rectifier type. All prices plus 12½ per cent Sales Tax. Special prices for quantity on application.



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Model PT34, overall size 3¾ x 2 3/8 x 1¼in. Sensitivity of meter, 1,000 ohms per volt. AC and DC voltage 0-10, 50, 250, 500, 1,000. DC Current range 0-1mA, 100mA, 500mA. Resistance 0-100,000 ohms. An efficient meter at a cheap price.

Price only 61/-

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LSG-10 WIDE BAND SIGNAL GENERATOR

The LEADER LSG 10 is an outstanding instrument with world-wide acceptance for its exceptional frequency coverage and the biggest value in its class. The range of 120 kc to 260 Mc covers practically all the requirements of receivers in general use.

SPECIFICATIONS:

Frequency Range (6 Bands) 120 Kc to 130 Mc on fundamentals. 120 Mc to 200 Mc on harmonics.

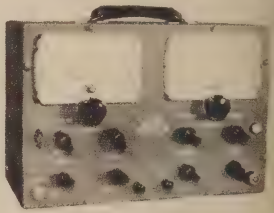
R.F. Output. Over 100,000 microvolts.

R.F. Control Variable with 2 taps.

Mod. Frequency Approx. 400 cps.
H.F. Output. 2 to 3 Volts.
A.F. Output. Approx. 4 volts.
Tube Complement: 12BH7, 6AR5.
Power Supply: AC, 50 cps, 220 V. 12 W approx.
Size and weight; 6¼in x 10in x 4¾in. 6lb.

Price £16/16/ plus £2/2/ tax. £18/18/ plus freight.

LSG-531 T.V.FM SWEMAR GENERATOR



Newly designed sweep and Marker Generator for use in servicing of TV and FM receiving sets. Used to obtain response curves on an oscilloscope screen. The compact LSG 531 is ruggedly constructed to withstand rough use either on the bench or in field.

FEATURES:

1. The sweep covers a range from 3 Mc to 270 Mc. in two continuous bands, covers all sound, video and F.M. frequencies, both carrier and I.F.
2. The Marker covers range from 3 Mc. to 225 Mc using fundamentals and harmonics.
3. The sweep deviation is very wide, better than 12 Mc. which permits the aligning of practically all the TV and F.M. sets on the market.
4. External insertion of Marker signals is possible.
5. A blanking arrangement is used to provide a base line for the response curve on the oscilloscope screen.
6. A 5.5 Mc. quartz crystal is supplied with the LSG-531 for extremely accurate marking of the sound channels and for frequency checks. Other crystals in the 1 Mc. to 10 Mc. range may be used.

Price **£78/16/8**—plus 12½ p.c. Tax **£9/17/1—£88/13/9** plus freight.

CONDENSER SPECIALS

The following is a list of a large variety of Condensers of all types, Mica, Block Mica, Paper Block and Tubular Oil-filled Block and Electrolytics. All are new and guaranteed to be in good order.

CAPACITY. WORKING VOLTAGE	TYPE	PRICE
.00017 mfd 4000V	Block Mica	3/6
.0003 mfd 600V	Block Paper	6d
.001 mfd	Mica	1/
,001 mfd 5000V	Block Mica	5/
.002 mfd 1500V	Mica	1/
.0025 mfd	Mica	1/
.005 mfd 2500V	Block Paper	9d
.005 mfd 1750V	Mica	2/
.01 mfd	Mica	2/
.01 mfd 1000V	Mica	2/
.01 mfd 2000V	Block Mica	3/
.01 + .005 + .005 600V	Block Paper	3/
.01 + .01 2000V	Block Paper	1/6
.015 mfd 2000V	Block Mica	3/
.02 mfd Type M Simplex	Mica	3/
.02 mfd 1000V	Mica	2/3
.02 mfd 1000V	Block Mica	2/6
.025 mfd 2000V	Block Mica	3/
.05 mfd 400V	Block Paper	6d
.05 mfd 400V	Tubular Paper	6d
.05 mfd 600V	Tubular Paper	6d
.1 mfd 1500V	Block Mica	4/
.25 mfd 400V	Tubular Metal	6d
.25 mfd 400V	Tubular Paper	6d
.25 mfd 600V	Tubular Paper	6d
.5 mfd 600V	Tubular Metal	1/
.5 mfd 4000V	Block Paper	5/
.5 mfd 700V	Block Paper	9d
1 mfd 500V	Block Paper	1/9
1 mfd 500V	Block Paper	1/9
1 mfd 1000V	Block Paper	3/
2 mfd 400V	Block Paper	2/3
4 mfd 350PV	Electrolytic	6d
4 mfd 400V	Block Paper	3/6
4 mfd 1000V	Block Paper	8/
4 mfd 2500V	Block Paper	12/6
4 mfd 800V	Block Paper	6/9
5 mfd 400V	Block Paper	4/9
3 + 5 mfd 110AC (400V DC Wkg)	Block Oil Filled	3/
8 mfd 525PV	Electrolytic	2/
10 mfd 40PV	Electrolytic	6d
16 mfd 400V	Oil Filled	10/
24 mfd 150PV	Electrolytic	1/3
24 mfd 350PV	Electrolytic	2/6
25 mfd 40PV	Electrolytic	1/6
14 mfd 600PV	Electrolytic	2/6
25 mfd 50PV	Electrolytic	1/6
50 mfd 40PV	Electrolytic	1/6
1000 mfd 12PV	Electrolytic	3/9
20 mfd 350PV 40 mfd 200PV 200 mfd 40PV 20 mfd 40PV	Can Type Multi Electrolytic	4/
.045mfd 16000V	Block	7/6
3000PF 6.5KV 1500PF 4KV 750PF 2KV	Multi Block Mica	7/6
50 mfd 200V Wkg 30 mfd 200V Wkg 100 mfd 15V Wkg	Multi Electrolytic	2/

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BRANCHES THROUGHOUT VICTORIA AND RIVERINA

signal suffers from severe interference from ada, which uses this same frequency for its ice to Europe and Africa from its Montreal lios.

ATICAN CITY has a new aerial system and very interested in reports from listeners re- ding transmission. According to the Inter- ional Shortwave Club Bulletin they use 21500 at 1030, 1200; 1220 G.M.T., and 21515 Kc 1600 G.M.T. The English news session from Vatican is broadcast at 1815 G.M.T. and t reception is on 9640 Kc.

BREMEN in West Germany is soon to have power increase to 10Kw. on 6190 Kc. The tion is still testing and the programs are broad- t from 0500-2300 G.M.T. On Sundays the tion opens at 0600 G.M.T.

BRAZILIAN station "Radio Nacional" at Bra- a the new capital has been noted on 9660 . from 0300 to sign off 0405 G.M.T., accord- to the Swedish DX Session.

DUTCH NEW GUINEA, with broadcasts from k is now using 7190 Kc. as well as 6070 Kc. e station has a program from 0900-1330, with program called "Island International Club" ry Saturday, 1240-1310 G.M.T., with announce- nts in English, Dutch and Indonesian.

JORDAN with broadcasts from Amman has pped its 7155 and 9530 Kc. frequencies for Home Service, and now uses the new chan- of 6020 Kc. This frequency is used with the 11810 Kc. and can be heard from sign on 00 G.M.T. The signal on 7155 Kc. is still ceived with the broadcasts to North America m 0115 to 0315 G.M.T.

RADIO RELOJ in San Jose, Costa Rica has en heard with broadcasts at 0700 on Sundays. station gives the time after each musical item. vin Dunham, of Lincoln, N.S.W., reports this tion as being best in his location from 0800 to 00, with stronger signals than one would expect m the 700 watts, which is listed as its trans- tting power.

NOTES from readers should be sent to rthur Cushen, 212 Earn Street, Invercargill, N.Z. All times are in G.M.T., 8 hours behind Western Australia, 10 hours behind East- rn Australia and 12 hours behind New ealand and Fiji times.

CANADIAN station CHNX at Halifax N.S. has creased its power and extended its schedule, d can be heard with news at 0600 and 0700, 6130 Kc. after which it suffers from inter- rence from the Port Moresby station VLT6. The HNX signals are heard again later and it seems w to be on a 24 hour a day operation.

This is one of the few Canadian stations which e privately owned and operate on shortwave with mmercial programs. The many commercial sta- ons in Canada have no shortwave relays, and gnals from Sydney, Toronto, Halifax, Montreal d Calgary are the only ones heard via short aves with relays of the Canadian domestic pro- ams.

SEOUL in its service to North America from 30 to 0600 G.M.T. uses 17815 and 15125 Kc. he program is in English, and the transmission gns on 0630 with the latter portion of the pro- am in Korean.

SOUTH AFRICAN signals are heard on new equencies according to August Balbi of Califor- a. The signal on 9650 Kc. replaces 9680 Kc. ith English from 0530, G.M.T., while the Spring- ok radio has been heard at the same hour on 50 as well as 9720, 7185 and 4945 Kc.

CAIRO is the location of the so-called "free- om" radio of South Africa. The station has a 5-minute session in English and this is being layed by Cairo Radio in their African service 2200 G.M.T. on 17690 Kc. The program uses e V for victory drum beat, and reports are quested to Cairo Radio, Cairo, U.A.R.

LISBON has altered the times and frequencies its English news sessions, the first is now on e air from 1315 to 1400 G.M.T. on 17880 and 1495 Kc, and 1715 to 1800 G.M.T. on 15380 nd 17895 Kc.

ALBANIAN station at Tirana has altered its equency to 7090 Kc from 7157 Kc, and is on e air 0330-0500 and 1900-2300 G.M.T.

BELGRADE'S Home program is now also roadcast on shortwave, and the transmission is n the air from 1400 to 2300 G.M.T. The station using 9625 Kc according to a report from the wiss DX Session, which gives reception as poor fter 1600 G.M.T., when Radio Moscow on the ame frequency causes severe interference.

ATHENS transmission in Greek for listeners Cyprus is now on the air from 1805 to 1845 nd uses the frequency of 7300 Kc.

ANKARA, in Turkey, is using the new fre- uency for its Home Service, and is reported rom Europe on 9480 to 9500 Kc and with pro- rams at 0500, 0600, 1030 and 1800 G.M.T. The rogram is a relay of the Home Service.

ISRAEL. As well as the English news at 015 G.M.T., Israel now has a session in Arabic n 7189 and 9723 Kc at 0430-0530, 1100-1 00 nd 1500-2130 G.M.T.

ANGOLA station of the Radio Club of Angola Luanda, has been noted on the frequency 9630 Kc. The signal is audible on this chan- el only from 1800 to 2000 G.M.T.

ETHIOPIA'S new mission voice is to be erect- d by the Lutheran Mission on a site of 300 cres of land 30 miles from its capital, Addis baba. The land has been placed at the dis- osal of the mission, and studios will be located Addis Ababa. Another mission broadcaster, his one in Switzerland, is reported by Radio ustralia as planning to commence with five hortwave and one broadcast band transmitters.

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44in drive	£4 15 0
72in drive	£12 10 0
58in drive	£7 10 0

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WHIT. ⅛ to 9 16 inch. 35/ set 4
OPEN END:
WHIT. ⅛ to 5/16 inch. 18/6 set 4
S.A.E., 5 16 to ⅞ inch. 30/ set 6
OPEN END RING:
S.A.E. ⅜ to 11/16 inch. 30/ set 6
WHIT. ⅛ to ½ inch. 32/6 set 6
METRIC 8mm to 22mm. 32/6 set

HYDRAULIC CONTROL UNIT
For conveyor belts, etc. Final drive in either direction of 240 r.p.m. from .6 h.p. motor.
£19/10/-
(5/- Delivery to Rail).

SPARK PLUG TESTER
Checks existence and density of spark. Clips inside the pocket like a fountain pen.
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(Post 1/-).

ELECTRIC PENCIL TESTER
Handy fountain pen-type tester for checking voltage up to 230 volts A.C. Clips inside the pocket.
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1in ball and socket mirror on an 8in stem, 10/6. Magnifying mirror on 6in stem, 7/6.
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SINGLE LENS. Supplies 300 magnifications. Adjustable to 100x and 200x. Complete with slides in wooden case.
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Both have provision for zero error adjustment.
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Tunes Include:
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30/-
(Post 1/-).

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Superior ex army, oil dampened compass suitable for hiking, taking of bearings, for fencing, grading and 100 other uses.
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0-5 amp AC DC	55/-
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(Post 2/6)

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TRANS. 12 volt 6 amp. 67/6.
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PRESSURE GAUGES
2½ inches diameter, 115lb per square inch.
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(Post 4 6)

VACUUM GAUGES
2½-inch diameter, 0-30 vacuum. Brand new with standard thread.
45/-
(Post 3/6)

BARGAIN MILLIAMP METER
3in round 0-1 milliamp meter. Brand new. Only £2/5/-.
(Post 2/-).

CRYSTAL SET PARTS

CRYSTAL EARPIECE ..	10/-
HEADPHONES	27/6
GERMANIUM DIODE .	3/6
MINIATURE CABINET	7/6
SLUG TUNED COIL (Complete with knob, condenser, and circuit)	16/6
TERMINALS	1/- each.
AERIAL WIRE	3/6

(Post 3/6 per part 5/- per set.)

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21/- pair.
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CAR RADIO CABINET & DIAL KIT PART 583. £5/18/9 tax incl.

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CAR IGNITION NOISE SUPPRESSOR

Part No. 28.
Consists of two RF and one laminated choke with a 1mf condenser, completely wired in a metal box. Connects in the active lead from the car to the Radio.

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453 Dial and Knob 300 pf Gang	12/6
458 Dial and Knob 300 pf Gang	12/6

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558 Amplifier Audio Transporta 6 and 7	25/-
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176 Double Tuned IF 455 Kc	14/
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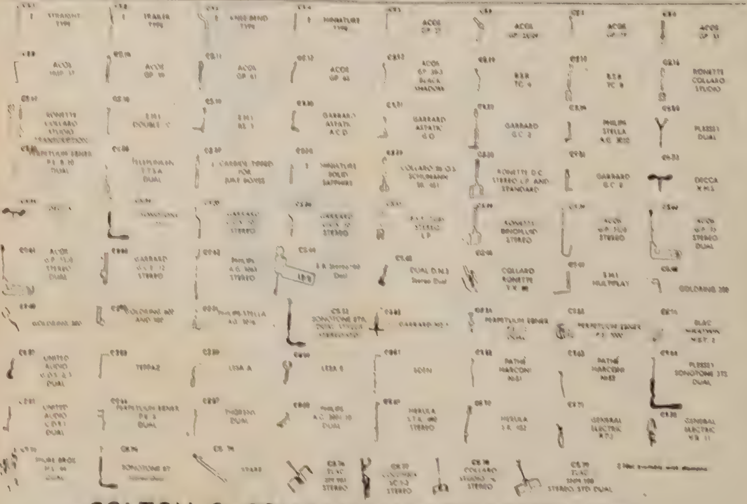
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ANSWERS TO CORRESPONDENTS

PROBLEMS OF ELECTRIC GUITARS

G.L.G. Brunswick, Vic., writes to say that he has constructed a guitar amplifier using a modified Playmaster No. 11 and a tremolo circuit from an overseas magazine and has found the results excellent. He makes several observations regarding guitar amplifiers in general and asks our advice on the output voltage of electric guitars, optimum input load impedance and the use of high value grid leaks with the EL84s used in the main amplifier.

A,. We must confess, G.L.G., that our knowledge of electric guitars is strictly limited but, from what experience we have had, it would seem that the output from guitars using electromagnetic pickup is very similar to that of the higher output magnetic pickups or dynamic microphones, namely around 30mV. The amplifier input impedance may be in the vicinity of 0.5 to 2 megohms.

The use of high value grid leaks is quite in order in the particular circuit used, there being no trouble from grid contact potential with the EL84 and the use of grid stoppers prevents any tendency to instability.

We agree that the use of separate bass and treble controls is unnecessary in a guitar amplifier, a simple top cut control normally being quite adequate. However, we do not agree that the bass response of the No. 11 Playmaster is excessive, the response being flat down to about 30 cycles. Rather, the bass response from the guitar should be limited before passing to the main amplifier.

Tremolo units usually require the use of a high-pass filter with a cut off below 20 cycles to prevent tremolo components affecting the speaker cone and causing it to pulse heavily. The use of tremulant plus heavy bass will all too readily overload a 10-watt amplifier in the usual entertainment situation.

J.A. (Pennant Hills, N.S.W.) asks if it would be possible to design a simple crystal receiver to receive signals from the television stations, enabling the audio material to be heard at little cost. He adds that he lives in a high-signal strength area, which may help matters.

A.: We have not heard of any such simple circuits, J.A. The matter is not simple, since the sound from a television station is frequency modulated. This would require a reasonable amount of circuitry, to allow the sound to be heard even in a makeshift manner. Another problem would be that the amplitude modulated picture signal would probably ride through in a most unpleasant manner.

* * *

F.J. (West Perth, W.A.) sends us quite a number of technical queries which he hopes we may be able to answer in the "Here's Your Answer, Tom" section of the magazine.

A.: Thanks for the queries, F.J. As you are no doubt aware, we have been covering the principles of measuring instruments in the "Answer Tom" section of the magazine, and may be unable to give suitable answers to your queries for a while. However, we will file them away for possible use when the space becomes available.

* * *

D.G. (Artarmon, N.S.W.) expresses interest in the articles recently presented regarding 16mm optical sound projectors, but suggests that the 8mm field is one which would appeal to a greater number of readers. He suggests a magnetic stripe attachment for projectors already in existence, designed to keep "keep costs down."

A.: We agree that there is a wide potential interest in adding sound to 8mm movies but, unfortunately, the techniques and facilities are not nearly as advanced as they are for 16mm. Thus, while we have heard some quite impressive demonstrations of 8mm sound, it does not follow that hobbyists can duplicate these results while attempting to "keep costs down."

D.R.P. (Geelong, Vic.) asks if we can help him regarding the supply of strip material for his radiogram cabinet.

A.: We are afraid we cannot help directly in this matter, D.R.P., but suggest you contact your local hardware store or timber supply firm. Alternatively a local joiner may be able to help. If you are considering using one of the new metal mouldings, such as we described in the article on the "Transistor 8 Cabinet" of July, 1960, we would advise you to contact the firm of Howard Silvers Pty. Ltd., of Harris Street, Ultimo, Sydney. This firm handles the "Schock" line of anodised aluminium mouldings.

* * *

A.J.B. (South Hurstville, N.S.W.) asks if we would consider running articles on the following matters: (1) How safe are picture tubes to handle? (2) Is there a simple way to work out input and output impedances of transistors in a given circuit.

A: Well, A.J.B., that's rather a tall order! We can't say at the moment whether we will be able to devote articles to these topics, but we do agree that one on the second of your questions might prove worthwhile. However, we would like other reader's opinions on this matter, as we always try to please the maximum number of readers.

Regarding the first question, the general rule when handling picture tubes seems to be to prevent the tube from receiving any knocks or bumps and to tighten up clamps only enough to hold the tube firmly. The old rule of "a couple of extra turns for good measure" should be forgotten!

Picture tubes are not "extremely fragile," as a trip through the valve factories will show! Anyone using normal care when handling them will usually be safe.

RADIO, TELEVISION AND HOBBIES QUERY SERVICE

TO assist our readers, "Radio, Television and Hobbies" conducts a technical query service. Conditions governing this service are set out below:—

(1) Requests for copies of circuits or technical queries requiring an answer through the post must be accompanied by postal note or stamps to the value of TWO SHILLINGS. Queries not accompanied by a fee will be answered in rotation on these pages.

(2) For the 2/ fee, we will supply circuit data, as available, for up to three projects. The amount of data available varies, but in no case can it include information additional to that already published in the magazine. As a rule, requests for circuits will be answered more speedily if they are clearly identified and not complicated by questions requiring the attention of technical personnel.

(3) The technical query service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits.

(4) The Editor reserves the right to return query fees or to limit the scope of an individual reply, where it is felt that a partial answer will be better than none at all. Please note that the inclusion of an extra fee does NOT entitle correspondents to special consideration.

(5) In addition to the normal query service, chassis blueprints are available for most of our projects, showing the position of all holes and cutouts for metal-working but containing no details of wiring, etc. Apart from complicated projects like TV sets and oscilloscopes, most blueprints cost 5/ each. Original photographs of most projects are also available, from 5/ for a 6in x 8in glossy print; postage 9d extra.

(6) Letters should be addressed to the Technical Editor, "Radio, Television and Hobbies," Box 2728, G.P.O., Sydney.

(7) "Radio, Television and Hobbies" does not deal in radio components nor will we debate the relative merits of competitive products. Prices and specifications of merchandise must be obtained from our advertisers.

(8) Technical queries are not answered by telephone.

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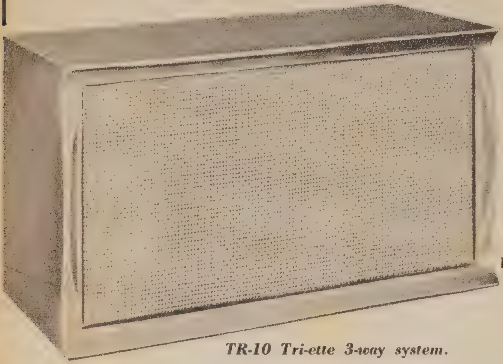

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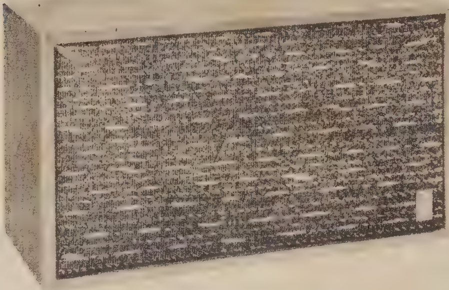

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PROTECT YOUR PROJECTOR LAM

(Continued from Page 41)

500 and (in parallel) 1000 watt ty
Physically, they look like small car
resistors, ranging from ¾in to 1½in
length and 5/16 to 7/16 in diame
They are fitted with metal caps and
tail leads.

Electrically, their position in the
tem is quite straightforward. T
simply connect in series with the la
If there is a fan in the system it is
ferable, but not essential, that
fan current not flow through the th
mistor. The maximum current rati
should be watched in this regard.

Of greater importance is th
physical placement and mounting o
the thermistor. Above everythin
else, safetly must be the major con
sideration since we are dealing di
rectly with 240-volt supply cables
In addition, certain precaution
must be taken to ensure correc
operation.

A major point is that the thermis
will get quite hot during use, up to
degrees C. in some cases, and that
mode of operation is not only norm
but essential. For this reason, extre
care must be taken to see that it c
not damage adjacent components, wi
etc., particularly where such dam
might affect safety.

The thermistor must be securely s
ported on equally secure terminals.
avoid any risk that the heat might m
the soldered connections the leads sho
be left at least half an inch long.
any case, both the thermistor leads
the power leads should be secur
twisted around the terminals to prov
a positive mechanical joint. Place
thermistor to one side or above
strip, never below it.

SEPARATE HOUSING

Before considering individual pro
tors, there is another approach wh
has some merit. This is to mount
thermistor in a separate housing, fit
with a three-pin plug and socket.
accompanying photograph shows such
arrangement, with the three-pin ou
mounted on the housing. This is u
ful where there is an objection to ta
pering with a projector, or where
facility needs to be shared. Fairly
viously, any one lead may only be u
with lamps of similar ratings.

More commonly, however, it is m
satisfactory to fit the thermistor perm
ently to the projector. The accompa
ing photographs show three typical
stallations

The first is an Agfa 150-watt mo
This is a fairly simple set-up. Th
is no forced draught and the thermis
may be mounted anywhere that is c
venient. As shown in the photogra
the lamp socket, reflector, etc., lift
as one unit. A metal strip used as
handle provided a convenient mount
point for a three-tag terminal strip
one of the power leads was cut and
minated on the two outer lugs.
thermistor for this size lamp is
CZ9A.

The next model was a 300-watt L
Pradovit, with forced draught cooling
automatic slide change mechanis

his case more care had to be taken rder that the cooling draught did not e complications and the accompany- photograph gives a good idea of the ement. The thermistor is the CZ11.

n eight-tag terminal strip was used, ified by removing four of the tags, mounted by taking advantage of ex- g holes in the chassis. One of these in a bracket near one edge, suitable a standard 1-8in nut and bolt. The r was in the diecast housing sur- nding the slide change gears and ewhat less conveniently placed. How- , a loop of wire, securely twisted, vided a simple solution.

MPLE MATTER

ince the relevant lamp lead was part the cable passing this point it was mple matter to cut it and terminate n the appropriate tags. Current for fan and slide change motor does pass through the thermistor.

ur final unit was a 1,000-watt Aldis n forced draught cooling. This pre- ted a special problem in that ther- tors are available up to 500 watts ng only. In fact, it was the absence a 1,000-watt thermistor which prompt- the description of the manually oper- d resistance unit in the March, 1961, e.

ntil recently, parallel operation of rmistors was regarded as impractic- e, since it is virtually impossible to duce two thermistors with identical stance. And, unless they are identical, lower one will pass more current n its partner, increase in tempera- e, pass more current, and so on until captures most of the current. Then, ause it is incapable of handling this ount, it will destroy itself.

However, S.T.C. engineers suggested t it might be possible to overcome s by providing an intimate thermal nd between the two units. In these cumstances both would have to run substantially the same temperature, is ensuring that they would also have proximately the same resistance and re the current equitably.

This idea proved highly successful, the ly limitation being that the pair should reasonably well matched for best ults. On this basis matched pairs of Z12s are now available for the price the two units, plus a small charge for tching. It is a relatively simple matter r the individual to bond these together nself.

The two units should be held together twisting the pigtails, then a generous ating of solder flowed over the end ps and across the space between. A riation of this idea is to cut a small ip of copper which may be laid against e end caps, then covered with solder.

Due to the high temperature at which these units work, the low melting point of "radio" solder—60 (tin). 40 (lead)—makes it unsuitable as a thermal bond. However, the "plumber's" type 50/50 solder has a higher melting point and is quite suitable.

Fitting the bonded pair to the Aldis ojector was quite simple. A pair of les was drilled in the metal sub-chassis d a six tag terminal strip mounted on The lamp lead from the nearby itch was diverted to the appropriate rminals, but the motor leads were left disturbed. The position chosen is clear the fan draught and components, and is clearly shown in the photograph.

Incidently, there is no need for alarm if your thermistor gives off a cloud of smoke the first time it is heated. This is due to a coating left over from the manufacturing process, and will not occur after the first heating.

The behaviour of a thermistor is not immediately obvious when the lamp is switched on. Most of the resistance change takes place in from 1/10 to ¼ second, which is rather too fast to follow. However, an AC voltmeter across the thermistor will make its action more obvious.

It should initially be set to the 250-volt range, and watched carefully as the switch is closed. In spite of its inertia the pointer will usually swing well past the 200 volt mark momentarily, then drop smartly to around 20 or 30 volts. In 10 seconds it should be down to about 10 volts, after which the rate of fall slows up considerably, requiring about two minutes to fall the last few volts.

The final voltage will depend on the size of thermistor and lamp. As already stated, it is about 4.5 for the 150 watt lamp, while the 1000 watt system runs at about 5.7. In no case is the loss likely to exceed a few per cent.

OFF THE RECORD

(Continued from Page 87)

"A Foggy Day," "Love Walked In," "Liza," "Lady Be Good," "Nice Work If You Can Get It," "They Can't Take That Away From Me," "I Got Rhythm," "Let's Call The Whole Thing Off" and "They All Laughed At Christopher Columbus."

The quality? Completely above reproach; "Hi-Fi" in the true sense of the term.

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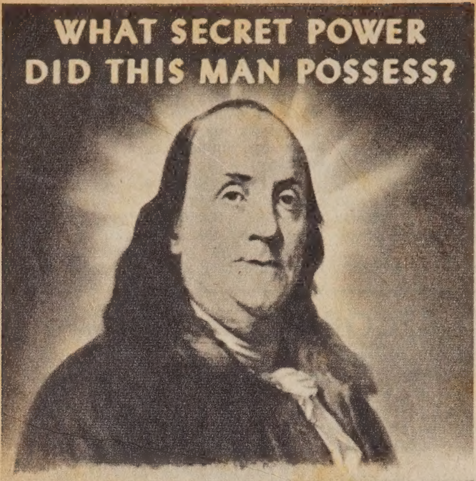

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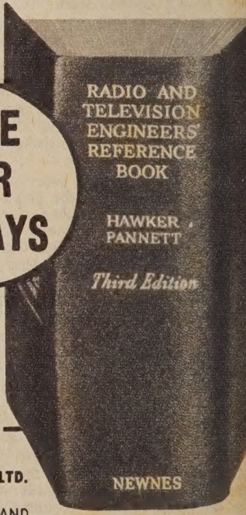

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cts We Seldom ink about

(Continued from Page 14)

ntre of the earth as the centre. The being constant no matter in which on the circle is drawn. Any other drawn from any other centre are circles. Thus the parallels of lat- drawn on the globe are small because they have their centres the earth's axis with different radii.

meridians of longitude are great because they have the centre of rth as their centres. If you have e of the world handy you can see I mean in a jiffy. If not another m given here will help you to get st of what I am talking about.

w the arc of a great circle is less than its counterpart on a small passing through the same points, se the great circle has a longer

s if you could put the point of of compasses at the centre of the and draw a circle so that the cir- rence will pass through Adelaide he Cape of Good Hope you would a curve like the dotted orthodrome e diagram and this would be the st distance between those two

you have a globe, take a piece of and stretch it between the two s and see what happens. It will fol- he curve as shown. Then hold it tretch it along the parallel of lati- You will find on comparing the measurements that the curved line shorter. (See diagram.)

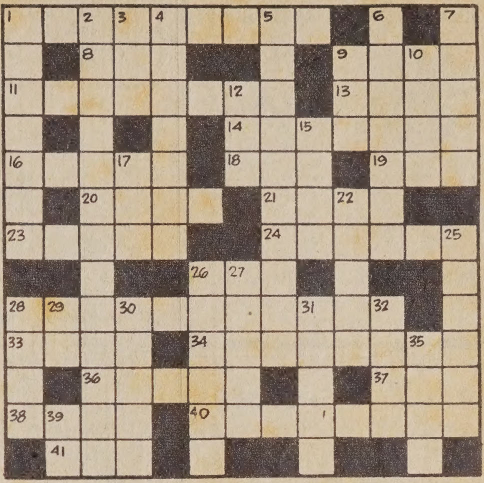
you stretch the twine between any points which are on the same lat- you will find that the twine does follow the latitude as marked on globe but a curved line above or according to whether you are or below the equator. As you ach the Equator the curvature be- s less because you are approaching only great circle of the parallels, ly, the Equator. Along this the est way is directly along it. The ture of the orthodrome south of the tor is in a southerly direction. North e Equator it is in a northerly dir- n.

he shortest distance between two s in a north to south direction on globe is along the meridians of tude because these are great circles, g the centre of the earth as centre.

me idea of the difference in dis- between the loxodrome and the drome on the map may be gained the previous example. Along the drome from the Cape of Good Hope delaide is 6,020 miles, while along orthodrome it is only 5,450 miles, a r distance of 570 miles.

trust that my dissertation on these questions has helped to clear up a problems for those interested read- who have stood the strain of getting far without being tempted to turn less enlightening article. One thing do I ask. Don't mention it if my ulations about air molecules are a w feet or miles out. Converting metres to feet and centimetres to es is a bit onerous after a heavy at the club.

THE R., TV & H. CROSSWORD No. 85



ACROSS

1. Characteristic of an alternating current.
8. Pronoun.
9. A clairvoyant.
11. Connecting devices.
13. Unmixed.
14. Having little or no magnetic property.
16. Shine.
18. Rocky height.
19. Expose hemp.
20. Coil tuning method.
21. Girl's name.
23. Moves about glumly.
24. No longer children.
26. Christian name.
28. It runs between the cathode and the grid.
33. First name of a film star.
34. Gripped.
36. A tenth part.
37. The unit of work.
38. Strip.
40. The storing of fodder.
41. A score.

DOWN

1. Alloy containing mercury.
2. A triode with input to the grid and outputs from the plate and cathode.
3. Cheek.
4. A narrow neck of land.
5. The relation between wave motions which are not in phase.
6. Non-active conductor.
7. Construct.
9. Spring.
10. Lake.
12. Turncoat.
15. Stepped.
17. Drink.
22. Scandinavian.
25. That which is left.
26. Hollow places in the wall.
27. English author.
28. Hold firmly.
29. Stands for the smallest of the U.S.A.
30. Diurnal.
31. Up till the time that.
32. Christian name.
35. Therefore.
39. And (Fr.).

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